ELECTRICAL REVIEW

THE PIONEER ELECTRICAL WEEKLY OF AMERICA

VOL. XLVIII. No. 25. NEW YORK, SATURDAY, JUNE 23, 1906. ISSUED WEEKLY

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PUBLISHING OFFICE . . . . . 13-21 Park Row, New York
WESTERN OFFICE: Fisher Building, Chicago, Ill. L. W. MARSHALL, Manager
BOSTON OFFICE: Delta Bldg., 10 Post Office Square, M. W. BARBER, Manager
EUROPEAN OFFICE: 42 Old Broad St., London, E. C., HENRY W. HALL, Manager

TELEPHONE "21 Cortlandt." Private exchange to all Departments.
REGISTERED CABLE ADDRESS: "Electview," New York.

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TO ADVERTISERS

CHANGES for advertisements should be in this office by *Friday noon* for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than *Monday noon* to assure publication in that week's issue.

SUBSCRIPTIONS

One Year, United States and Canada $3.00
One Year, Foreign Countries 5.00
Single copy, 10 cents. Back numbers, beyond one month, each . . .25

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ELECTRIC SIGNALING.

Electric methods of signaling have made great strides in railway operation during the last few years. In fact, in much of the newer railway work automatic electric methods of operating blocks and of controlling interlocking switches have been adopted. But the development has not stopped here, for several important roads have extended their signaling systems so that the man in the tower is automatically informed of the condition of the tracks under his control. A very pretty means of doing this has been adopted by the Metropolitan District Railway, of London. It, in brief, consists in placing before the switchman a translucent diagram of his tracks. Incandescent lamps are placed behind this, arranged so that each lamp illuminates one operative section of the track. These lamps are lighted whenever the tracks are free, but each is automatically extinguished whenever there is a train on that particular section. Thus, by a glance the operator knows what tracks are occupied and what are clear, and, since he is not left entirely dependent upon his memory, he works with greater confidence.

Another feature also used by the same road assists in controlling the trains. The rule of the road requires the conductor to verify each signal before allowing the engineer to proceed, but as it is frequently impossible for the former to see the signal placed for the latter, a set of supplementary signals has been introduced especially for the information of the conductor, so that he can at a glance verify the orders from any point in the train.

A third signaling device, known as the train describer, is used to describe to the switchman each train, thus supplementing the automatic block signal system in which the only indication given to the switchman is that a train is approaching his station. This consists of a transmitting device, on which are represented the different headlight combinations carried by the trains. When a train leaves a switch station the man there turns his transmitter to that position corresponding to the train, and thus automatically reproduces at the next station the signal, so that the operator there knows which way that train is to be sent. On this particular road this device provides for fifteen different train destinations, and must send fifteen separate signals. It is automatic in its operation, requiring only that the man at one station set it to correspond to the train leaving there. When there are a number of trains between two signaling points these signals are stored up and are reproduced in the proper order, one after the other, as they pass the second point, the man at the latter station simply canceling each signal as the train passes him, when the next immediately appears.

Still another convenient signaling device has been installed in certain of the stations on this important road. This is what is known as the train destination indicator. It consists of a number of signs, on which are indicated the points to which the several branches of the road reach. Beside these are placed numbers which can be lighted up by means of lamps placed behind them, the numbers thus showing the sequence in which trains are approaching the station, and by a glance at it the passenger can tell whether he should take the first, second or third or wait for a still later train. These signals are automatically changed

as any one train leaves the station so as to show the order of the next three.

These four extensions of electric signaling indicate the great part to be played in the railroad of the future by such telegraphic devices. Already such progress has been made as to increase materially the safety of travel and to facilitate the handling of passengers and the despatching of trains. The electric telegraph has always played a most important part in railway operation; in fact, without it and the newer developments of a similar nature the operation of a railway, as now understood, would be practically impossible.

COMPOUND ALTERNATING-CURRENT MOTORS.

A striking feature of certain recent developments in alternating-current motors has been the use of a combination of elements which gives the motor characteristics which are the resultant of those of the simpler elements. In this way it has been possible to design a motor whose performance corresponds to that of the compound direct-current machine. As is well known, the direct-current shunt motor is a constant-speed machine, the speed varying but slightly with the load. The series motor, on the other hand, is a variable-speed machine, the speed being dependent upon the load. The latter machine possesses the property of excellent starting torque for any given armature current.

Each of these simple motors is suitable for certain classes of work, but there are intermediate conditions where it is desirable to obtain, to some extent, the characteristics of both the series and shunt machines, which is done by compounding. Such a combination produces a motor which gives a greater starting torque for a given armature current than would be obtained by the use of the shunt element alone. On the other hand, the addition of the compound winding, acting, as it does, to vary the strength of the magnetic field, affects also the speed of operation, so that the motor is not a constant-speed machine, the speed falling off slightly with an increase in the load. This falling off of the speed is greater than that which would take place if the series element were omitted, but for work where it is necessary to start and stop frequently this feature is not generally a disadvantage. If, on the other hand, a very constant speed is desired, more constant even than can be obtained economically with the shunt motor, the compound winding may be connected up in the reverse direction, so as to oppose the shunt winding. In this way a weaker field results with increased loads, and the motor can be made to give an exceedingly constant speed, or even to increase in speed with an increase in the load.

Similar results can be secured by a combination of the corresponding alternating-current elements. The induction motor corresponds to the shunt motor, as it is a constant-speed machine. The repulsion motor, on the other hand, and a number of the new commutating types have characteristics resembling the series motor, so that by combining the induction type with one of the latter a motor whose performance resembles that of the compound direct-current motor is obtained. This is what has been done to secure the motor described by Mr. Maurice Milch in the paper which he read at the recent convention of the American Institute of Electrical Engineers. Mr. Milch has combined the single-phase induction motor with the repulsion motor. He thus obtains a single-phase motor, which, unlike the single-phase induction motor, is not only self-starting, but has good starting characteristics, and which, when operating under normal loads, has a fairly constant speed. The slip of such a motor must be greater than that of the simple induction motor, if the benefits of the repulsion element are to be obtained for starting purposes. On the other hand, if it be not important to have a large starting torque by a different proportioning of the two elements a more constant speed can be obtained. Such a motor corresponds very closely in its performance to the compound direct-current machine, and it should be suitable for application in places where the latter machine has been used so successfully.

It is interesting to note the relation between direct-current and alternating-current apparatus. Usually the two types of machine are thought to be entirely dissimilar. In some ways this is true, but there will be found, in general, a much closer resemblance than would at first be expected. The direct-current machine, in spite of its complicated structure, was the first to be highly developed, and may be looked upon as a special case of alternating practice where the frequency of the circuit has been reduced to zero. In this case the troublesome and perplexing problems arising from the alternating character of the current were for a time set aside, and other features of the apparatus were studied and developed. We thus learned how to construct a machine which would provide its own excitation; then we found how we could regulate the excitation so as to produce a constant potential, irrespective of the load on the machine. In motor development we learned how to obtain the different characteristics suitable for various kinds of work. Later, when the flexibility of the alternating-current system was realized, the old methods developed for direct-current practice were applied, modified, of course, to meet new conditions; and, more recently, we have seen a still wider use of direct-current methods in alternating-current machinery. Self-exciting alternators have been designed, which not only provide the initial excitation, but which compound automatically not merely for the change in the quantity of the load, but for the more troublesome change in the quality or power-factor. The latter is a feature which was absent in the old direct-current machines. We have even gone so far as to construct an alternator, which, except for the method of excitation, is really a direct-current machine, the alternations being secured by means of alternating field excitation.

The same lines of development have been followed in motor practice, though not so rapidly, for the problem of commutation has been troublesome. But we now have alternating-current motors which correspond in their characteristics to the direct-current series motor, the shunt motor, and, in this new machine, to the compound motor. In fact, alternating-current practice has appropriated to itself all the good things produced by the direct-current engineers at so much labor and after many years of hard work.

THE CANADIAN REPORT ON THE ELECTRO-SMELTING OF IRON ORES.

In the latter part of 1903 the Canadian government appointed a commission to investigate the question of the electro-smelting of iron ores. This commission, it will be remembered, made a trip to Europe to examine the work which had been done there, and, upon its return, submitted a voluminous report on the subject. Since the conditions, however, were not entirely in agreement with those in Canada, it was deemed advisable, before going further in the matter, that some actual experiments should be made, using for this purpose the Canadian ores and the materials which would be used if the process were put into actual operation. These tests were carried out during the past winter at Sault Ste. Marie, Ontario, by Dr. Eugene Haanel, chairman of the commission, assisted by Dr. P. L. T. Héroult, and some of the results were made known in a public address given by Dr. Haanel. The preliminary report of this work has just come to hand.

The report takes an optimistic view of the problem, for it is thought that magnetite, one of the principal ores of Canada, can be smelted by this method as easily as hematite. It finds that ores containing a good deal of sulphur can be used and a good quality of pig iron produced, that the amount of silicon contained in the product is largely under control, and that the reduction can be carried out with charcoal instead of coke. The decisions are important, for these are the materials which the Canadian iron producers will have to utilize. That a good quality of iron can be produced from them can not be questioned, for it was accomplished in the comparatively small furnace which the committee constructed.

The main question would seem then to turn upon the cost of the process; in fact, this has really been the most important question all along, because there has been no question about the ability of the electric furnace to accomplish all that can be done in the old type of furnace. It is only a question of proper construction and proper control of the heating agent. The figure given for the cost of production of a ton of pig iron is $10.69. This is based upon an estimate for a 10,000-horse-power hydroelectric plant and furnaces for producing 120 tons of iron during each day of twenty-four hours. It is estimated that the furnaces and accessories would cost $100,800; the plant for producing the charcoal, $50,000; the power plant, $500,000; the plant for producing the furnace electrodes, $6,000. This brings the total up to $656,800, or, say, $700,000, allowing for unforeseen expenditures. From this figure it is estimated, allowing fifteen per cent for amortization, interest and depreciation for the entire plant, that this would amount to $2.43 per ton of iron produced. This estimate is based upon a production of 4.32 tons of pig iron per horse-power-year—a figure arrived at from the tests, though, in but one instance only was this figure approached. Moreover, it is based upon a number of individual runs and it remains to be seen whether it can be maintained under commercial conditions. It should therefore be accepted with some caution. From the two experiments made in Europe results differing very greatly were obtained, one being more than twice that of the other; while the average of the two was less than 2.9 tons per horse-power-year. An estimate for the cost of power, which, following the committee's method, we may take at fifteen per cent of the cost of the hydroelectric plant, comes to $7.50 per horse-power-year not including labor. This is a very low figure, and it is based upon an assumption of a hundred per cent load factor, a condition hardly to be expected in Canada where the winters are hard and long. It seems probable, therefore, that in actual practice the results would be less favorable than those indicated in the report, unless, of course, a considerable improvement in the method can be brought about. Something of this kind was suggested in the attempt of the committee to utilize the furnace gases for preheating the charge, but the experiment has not yet been successful. We can only hope that further experiments in this matter, which, doubtless, will be conducted, will bear out this report. It is a question of the greatest importance to Canada, and, indeed, to the whole world; too important in fact to be settled by a single series of tests.

PROGRESS IN ELECTRICAL THEORY.

An interesting and important contribution to the electrical theory of matter has been made to the *Philosophical Magazine*, of London, by Professor J. J. Thomson. In his discussion of the corpuscle theory of matter Professor Thomson has again and again hinted at a close relation between atomic weight of an atom and the number of corpuscles which it possesses. He has even hinted that these are numerically identical. In the article referred to he makes this as a definite suggestion, and in support of his idea attacks the problem in three directions, each time arriving at the same point.

The first attack is based upon the dispersion of light which is caused by gases. If, as is supposed in this theory, an atom consists of a positively charged sphere containing the corpuscles or negatively charged particles, the electromagnetic forces set up in the system by light should cause a sort of polarization of the gas, and this polarization will react on the specific inductive capacity of the gas. The action will depend upon the number of corpuscles contained in the atom and upon the wave length of the light. It is found that the dispersion caused by different gases points to the identity suggested above.

The second argument depends upon the scattering of Rœntgen rays. It has been shown theoretically that this scattering depends on the number of corpuscles in unit volume of the gas, and hence upon the atomic weight. Following this idea out, Professor Thomson comes again to the same conclusion.

The third argument depends upon the absorption of β rays from radioactive substances when they pass through matter. This absorption is supposed to be due to collisions occurring between the rays themselves and the corpuscles of the atoms of matter, which, in turn, depend upon the number of corpuscles, and this method, when followed, leads to the same conclusion.

The paper is an important one, for it points to a simpler state of affairs than had been thought of. An atom of hydrogen, for example, instead of containing a large number of corpuscles, possesses only one of these little charged bodies and other elements in numbers equal to their atomic weights. The coincidence, while striking, is easily appreciated as we have selected as our unit of atomic measurement that active element having the lightest weight, and it is univalent.

A Study of the Magnetic Properties of Sheets by the Wattmeter Method.

A critical study has been made by M. R. A. Jouaust of the wattmeter method of testing sheet iron. The method, as proposed by Gumlich and Rose, contemplates the substitution of this simpler method in place of the old and rather troublesome ballistic galvanometer method; but it seems to the author that the directions for conducting the tests are not sufficiently definite. To test it, a ring was built up of sheets of iron, each carefully shellacked and then coated with a thin paper, in order to insulate adjacent layers. This was wound with a coil and connected to a source of electromotive force giving an approximately sine wave, an ammeter and a wattmeter being placed in the circuit. A voltmeter and the pressure coil of the wattmeter were connected directly across the terminals of the coil. With this arrangement it was necessary to correct the wattmeter readings for the losses in the voltmeter. It was found necessary to avoid introducing any auxiliary resistance in the circuit in order to avoid affecting the wave form of the generator. It is advisable to check the wave form by means of an oscillograph, for if this is not done an error which is not negligible may be introduced. The wattmeter employed should be carefully chosen, and one having a small inductance is to be preferred. It is necessary to take readings at several frequencies, in order to enable the several losses to be separated. The German directions call for the test at a single frequency. It is also desirable to vary the induction somewhat, as it is impossible to obtain exactly that called for. It was found that if the insulation of adjacent laminæ was not good that a considerable error was introduced. The effect of these Foucault currents was to increase apparently the coercive force, without affecting the retentivity. The author concludes that if it is simply desired to obtain a value for the iron losses that the wattmeter method gives more accurate results than the ballistic method; but when it is desired to investigate the characteristics of the iron, the wattmeter method, as proposed, is not satisfactory; and when it is desired to determine the permeability of a sample, the ballistic method is the more precise. Although the wattmeter method is delicate, it requires a number of corrections to be made. It calls for an alternator whose wave form is known. It is not thought that the new method will displace the old.—*Bulletin de la Société Internationale des Électriciens (Paris), May.*

Electrical Contractors' Association of New York State Convention.

The semi-annual convention of the Electrical Contractors, of New York state, was held at the Vanderbilt Hotel, Syracuse, N. Y., June 19. There were about forty delegates present, most of whom arrived on Monday evening, so that an early start was made on the Tuesday morning session.

After the formal sessions in the morning and afternoon, the delegates were given a trolley ride, and a visit was made to White City.

In the evening a banquet was held at the Vanderbilt, at which a number of informal addresses were made.

The association decided to hold its next meeting in New York city in January.

The entertainment committee included James R. Hilton, Edward F. Joy, William Gough and D. Miller.

New York City Franchise Decision Postponed.

It was definitely decided at the meeting of the board of estimate, New York city, on Friday, June 15, that no action would be taken on the application of the Atlantic Telephone Company for a franchise until the New York Telephone Company has had an opportunity to ask for a direct franchise in the city, instead of operating under the charter of the Empire City Subway Company. A week previous the board, sitting as a committee of the whole, recommended that the New York company should have thirty days to consider the proposition. That recommendation was formally agreed to by the board of estimate at its last meeting, on June 15. No action can now be taken on the telephone situation until the fall, for the reason that the board will adjourn for the summer before the thirty days expire.

Telephone Duplication.

The New York Telephone Company has compiled a portfolio of advertisements, booklets and pamphlets issued by that company and the New York & New Jersey Telephone Company on the subject of telephone duplication, together with a few editorial comments. This portfolio is an interesting example of the extent to which advertising and publicity may be used to appeal to the public. Apart from the value to the company as a means of stating its case, the series of advertising is certainly one that, typographically, reflects great credit upon those who have been responsible for its make-up; and much of its direct influence is due to the effectiveness of display which has been secured.

Electrostatic Separation of Copper Ores.

An abstract is given here of a recent discussion of the use of the Blake electrostatic ore separator on copper ores by W. G. Swart. With few exceptions, the copper minerals are conductive toward static electricity, though the silicates are the least so. Up to the present time, however, no satisfactory work has been done with these ores, although laboratory work leads the author to believe that the case is not hopeless. The carbonates are not much better, though the pure materials are ordinarily conductive enough to be separated readily from the silicious gangue. The oxide of copper is a conductor, so that if the silicates and the carbonates are oxidized they too may be easily separated. The compounds of copper with sulphur, arsenic and antimony are good conductors, and in certain deposits where these ores are partially oxidized they can easily be separated. The most interesting work of this kind has been done recently at the Lake Linden mill of the Calumet & Hecla Company, where a Blake separator was installed for experimental purposes. It was hoped that by this means copper could be saved from the jig tailings, but it was found that the saving was no better than that of the present wet method, and on account of the money invested in the apparatus for the latter system the idea was abandoned. In the same district there are, however, sandstone deposits which do not yield readily to the wet method, and these, it is thought, can be satisfactorily treated with the Blake machine. Some results are given of tests with sulphide ores, in which the amount of copper in the headings was 4.4 per cent, which was concentrated to thirty-nine per cent by means of the machine. A field for the electric separation is to be found in the arid regions where water for milling purposes is unavailable, for here, even though the results are no better than those which can be obtained by the wet process, the fact that water is not needed is a great advantage. Another application of electrostatic separation is in the treatment of flue dust from the copper smelter, the furnace charge of which consists of copper and iron sulphides and oxides, the usual silica, lime and constituents of the charge. A desirable concentrate is obtained from this material, which enables the tailings to be discarded altogether, and relieves the furnace of about seventy per cent of the flue dust ordinarily returned. The three principal difficulties encountered in the work with the electrostatic separator are the insulation, the proper way of feeding, and the dust problem.—*Mining Magazine (New York), June.*

Conventions of the Master Car Builders' Association and the American Railway Master Mechanics' Association.

Atlantic City, N. J., June 13-20.

IT IS estimated that more than four thousand people attended the conventions of the Master Car Builders' Association and the Master Mechanics' Association at Atlantic City, N. J., last week. The first of these, the Master Car Builders, were in session during the days of June 13, 14 and 15. This session was opened by President Joseph Buker, following whom, the mayor of Atlantic City, Hon. F. P. Stoy, welcomed the members of the associations. The report of the president shows the association to have a total membership of 631 and a representation of 2,047,327 cars.

The sessions were largely given up to open discussions inspired by the papers present and nearly the whole realm included in car construction and operation was covered. The following is a list of the officers elected to serve for the ensuing year:

President, W. E. Fowler, Canadian Pacific.

Vice-president, G. N. Dow, L. S. & M. S.

Second vice-president, R. F. McKenna, Lackawanna.

Third vice-president, R. W. Burnett. Erie.

Secretary, J. W. Taylor, Chicago, Ill.

Treasurer, John Kirby.

Executive committee, J. F. Walsh, F. N. Hibbits, F. T. Hyndman.

The sessions of the Master Mechanics' meeting were held in the sun parlor at the ocean end of the steel pier on Monday, June 18. The session was opened by a prayer, following which the address of the president was delivered. Then the routine matters, such as the minutes of the last meeting, the reports of the secretary and treasurer and other matters were considered, following which appointments of committees were taken up.

The first discussion was introduced by Professor W. F. M. Goss on "Is Not a Boiler Pressure of 185 Pounds Better Than 200 Pounds for Locomotives?" Other discussions followed bearing on various mechanical and practical questions pertaining to the mechanics of railway equipment and operations. On Wednesday morning, a careful paper was presented on "Electricity on Steam Railroads."

Among the exhibitors and attendants were: the Crocker-Wheeler Company, Ampere, N. J., represented by Messrs. Julian Roe, manager Chicago office; Rodman Gilder, H. C. Petty, S. H. Russell, Jr., and L. Patteson.

Allis-Chalmers Company, Milwaukee, represented by F. C. Randall, manager New York office; C. A. Tupper and Guy Shafer.

American Vibrator Company, St. Louis, represented by F. B. Small.

Brown Hoisting Machinery Company, Cleveland, J. P. Case, Richard Devens.

Carborundum Company, Niagara Falls, N. Y., C. O. Taylor, E. J. Eames.

Chicago Pneumatic Tool Company, Chicago, Ill. This company exhibited a line of storage batteries, electric drills, pneumatic hammers, compressors, and other construction equipments. The company was represented by W. O. Duntley, J. F. Duntley, Thomas Aldcorn, Julius Keller, Jas. M. Towle, W. P. Pressinger, G. A. Barden, C. E. Walker, W. S. Keller, Wm. Curtis, W. H. Travers, B. H. Tripp, H. Keller, H. Hunter, H. E. Epley, Fred Severin, Julius Keller, Jr., R. Kimman, Chas. DeC. Aldcorn, Jas. L. Fannon.

Cling Surface Company, Buffalo, Jos. E. Sherry, C. F. Chase.

Consolidated Railway Electric Lighting and Equipment Company, New York, John T. Dickinson, Thos. Mount, P. Kennedy, W. M. Lalor, J. L. Watson.

Dearborn Drug and Chemical Company, Chicago and New York, W. B. McVicker, Geo. R. Carr, G. F. Duemler, R. W. Francis.

Lincoln Electric Company, Cleveland, H. M. Hitchcock.

Merritt & Company, Philadelphia, S. Morris, L. S. Engless.

Morse Twist Drill and Machine Company, New Bedford, Mass., W. T. Read, F. D. Chalmers.

Rushmore Dynamo Works, Plainfield, N. J., S. W. Rushmore, E. W. Poiner, J. Parent.

Sauvage Safety Brake Company, New York, Fritz J. Frank, W. H. Sauvage, A. P. Smith, E. Burgess, C. F. Pierce, Wm. J. Richardson.

Sprague Electric Company, New York, represented by G. G. Connor, E. H. Watlington, A. E. Bradell, F. S. Douglas and A. C. Bakewell.

Standard Paint Company, New York, represented by J. N. Richards, J. H. Thomas, E. C. Beckman, V. C. Dwyer and Paul M. Wade.

Yale & Towne Manufacturing Company, New York, represented by W. C. Bigelow and C. W. Beaver.

General Storage Battery Company, New York, represented by F. E. Boos and Robert C. Shaal.

Albert & J. M. Anderson Manufacturing Company, Boston, represented by W. H. Woltman.

Gould Storage Battery Company, New York, represented by Wm. S. Gould, vice-president, and George H. Milne.

Mason Regulator Company, Boston, represented by Frank A. Morrison.

American Vibrator Company, St. Louis, represented by B. F. Small, J. O'Brien, R. V. Clark and A. B. Dabb.

Electric Storage Battery Company, Philadelphia, represented by Chas. Blizard, J. W. White, A. Adam and H. E. Hunt.

Wellman - Seaver - Morgan Company, Cleveland, represented by W. A. Stadelman, A. S. Blanchard and Fred Stadelman.

Gould Coupler Company, New York, represented by Dr. C. W. Gould, Wm. S. Gould, George H. Milne, S. R. Fuller, Jr., and W. R. Richards.

Bridgeport Brass Company, New York, represented by Edgar H. Bedell.

The Westinghouse exhibits comprised the products of the Westinghouse Air Brake Company, the American Brake Company, the Westinghouse Automatic Air and Steel Coupler Company and the Westinghouse Electric and Manufacturing Company. The location of these headquarters was at the far end of the steel pier.

The Westinghouse Air Brake Company exhibited the new and old locomotive equipment arranged both for single engine and double heading. Also, it included an equipment for two seventy-five-car freight trains arranged in parallel.

The Westinghouse Electric and Manufacturing Company showed a full line of arc lamps for all current, also motors for use on alternating and direct currents for shop driving. A complete collection of Westinghouse current measuring instruments and other electrical apparatus especially adapted for use in railway shops was also shown.

The entire exhibition was lighted by Cooper Hewitt mercury vapor lamps.

The representatives of the Westinghouse

companies in attendance were the following: Westinghouse Air Brake Company, H. H. Westinghouse and J. F. Miller, vice-presidents; A. L. Humphrey, general manager; W. S. Bartholomew, Jos. R. Ellicott, E. L. Adrean, T. A. Hedendahl, F. V. Green, S. G. Down, S. J. Kidder, F. T. Reese, S. D. Hutchins, W. V. Turner, C. C. Farmer, C. J. Olmsted, Arthur Johnson, Robert Burgess, C. P. Cass and Henry S. Mann. Westinghouse Automatic Air and Steam Coupler Company, N. F. Niederlander, president. American Air Brake Company, E. L. Adrean, vice-president and general manager. Westinghouse Electric and Manufacturing Company, E. M. Herr, vice-president; C. F. Street, H. Klinck, J. M. Barr, D. D. Pendleton and Charles Robbins. Associated interests, Frank S. Smith, O. H. Miller and J. C. McQuiston.

The General Electric Company, Schenectady, N. Y., made an interesting exhibit and was well represented by J. R. Lovejoy, L. R. Pomeroy, C. C. Pierce, H. D. Hawks, A. W. Jones, J. J. Mahoney, F. A. Larkin, H. D. Tremper and F. H. Gale.

Annual Meeting of the New York Electrical Society.

The annual meeting of the New York Electrical Society for the election of officers was held in the College Hall, Hotel Astor, June 13. The following ticket was elected:

President—George Herbert Condict.

Vice-presidents—Robert T. Lozier, Walter F. Wells and P. G. Gossler.

Secretary—George H. Guy.

Treasurer—H. A. Sinclair.

The report of the secretary showed that during the past season fifty-nine members were elected; the society lost two of its members by death, and thirty-two resigned. The total membership is 662. Although the report of the treasurer showed a working deficit of $39.17 on February 1,—the end of the society's fiscal year—the present condition of the finances promises well for a marked improvement in the budget of the coming season.

Much interest was aroused by the announcement that the officers of the society are hopeful of securing quarters in the United Engineering Building, so that the many advantages of that edifice may be made available to the members of the society.

After the business meeting there was a smoker. Excellent music was provided by the Eureka Trio. Among the speeches was a characteristic and witty recital of some of his experiences by Charles L. Eidlitz. An excellent collation was served, and the evening was voted a distinguished success.

The San Francisco Service of the Western Union.

The report of the San Francisco (Cal.) grand jury, scoring the officers of the Western Union Telegraph Company for alleged insufficiency of service during and immediately after the fire, has been resented with a good deal of emphasis by President Robert C. Clowry, of the Western Union company.

"Our company," Mr. Clowry says, "did more to help the stricken folk of San Francisco after the fire than any other company or corporation in my knowledge. This report upon the incompetency and alleged frauds practiced by the Western Union comes with a poor grace from the people of San Francisco, concerning whose plight we furnished free bulletins to 23,000 offices throughout the country during the progress of the fire.

"Immediately upon the receipt of the first news of the earthquake this office gave notice that telegrams, money orders or any other telegraphic communications to the various relief bodies in San Francisco would be received in any of the company's offices and forwarded absolutely without charge. We also handled, and we are still handling, free of tolls, cables from Europe sent to San Francisco in reference to relief.

"We accepted all messages on the strict reservation by the company that they would be subject to delay in delivery. The delay, we said, would be indeterminable, knowing that with the removal of many thousands from their former addresses and the congregation of others into relief camps the difficulty in locating individuals addressed by telegraph would be enormous; yet the public swamped our offices with telegrams.

"A special permit from the War Department had to be obtained before our messengers could go to and fro on the guarded streets of San Francisco. Further, all of our lines within a radius of fifty miles of San Francisco were brought down by the earthquake, and, in some instances, the re-establishment of communication was not immediate.

"When messages were delivered we found the utmost difficulty in locating those to whom they were consigned. The people of San Francisco were scattered in Oakland and adjacent cities to such an extent as to make their location almost prohibitive. We had to publish daily lists of undelivered telegrams and have the people call for them. A few messages filed from towns near San Francisco were mailed to that point, but telegrams from a distance were sent to the nearest central relay station possible and thence forwarded by messenger."

Outing of the Independent Electrical Contractors' Association of Greater New York.

The second annual outing and clambake of the Independent Electrical Contractors' Association of Greater New York will be held on July 7 at J. M. Donnelley's Boulevard Hotel, College Point, Long Island, N. Y. The association is composed of several hundred electrical contractors. Special interest is being taken in the proposed athletics, and prizes will be awarded for bowling and to the winners of the baseball and other games.

The Second Battery band, headed by G. E. Fuller, will furnish music.

The party will assemble at East Thirty-fourth street ferry, New York city, at 12.30 P. M., where they will sail to Long Island City and board special trolley cars which will convey them direct to the hotel.

The committee in charge is as follows: Frederick C. Schafer, A. Neuberger, B. Glidden, E. Christesen and C. Hagemeyer.

The officers of the association are: President, T. Whitehead; vice-president, A. Neuberger; treasurer, F. C. Schafer; financial secretary, C. A. Christesen; recording secretary, F. W. Cohn; sergeant-at-arms, B. Glidden.

Meeting of the Illinois Electrical Contractors' Association.

The Illinois Electrical Contractors' Association held its semi-annual convention at Rock Island, on June 9. A business meeting was held both morning and afternoon, and the banquet and informal meeting were held in the evening.

At the afternoon session the following officers were elected:

President—John T. Marron, Rock Island.

Vice-president—F. B. Bolte, East St. Louis.

Secretary—C. R. Krieder, Chicago.

Treasurer—E. E. Gibson, Decatur.

Directors—Henry Newgard, Chicago; Charles Stapp, Peoria; J. W. Tanner, Danville.

Delegate to National convention, Cleveland, Ohio, July 18-20, John T. Marron.

Report of Earnings of the Manila Electric Railroad and Lighting Corporation.

J. G. White & Company, operating managers for the Manila Electric Railroad and Lighting Corporation, report the earnings of that property for May, 1906, as follows: Railway department: Gross earnings, $44,000; net earnings, $21,750. Light and power department: Gross earnings, $28,000; net earnings, $12,600. Total net earnings, $34,350.

The earnings of the railway department for the week ending June 7 were $10,700.

THE EDISON SYSTEM OF SOUTHERN CALIFORNIA.[1]

BY R. H. BALLARD.

From the spring of 1895 to the spring of 1896 there was operated, first just outside of the city limits of Los Angeles, and later just inside (by reason of the extension of the corporate limits of the city), what might be called a miniature electric lighting plant. During this time efforts were being constantly made to secure a regular city franchise for this plant, but not until the spring of 1896 was this accomplished; at that time, after a franchise had been twice refused, an old one turned up and was promptly purchased by the owners of this little plant. This franchise had never been used and would lapse in just two weeks' time unless light were furnished to the City Hall. By an almost superhuman effort, and with the assistance of one of the street railway companies (on whose poles lighting wires were strung), one cluster of lights was turned on in the City Hall on the night before the day on which the franchise would have lapsed. Thereupon the West Side Lighting Company was incorporated, with a capitalization of $500,000 and an authorized bond issue of $300,000, and the more serious troubles of finance and the securing of business began, as the fight was then against a financially and politically well-entrenched company. The legality of the franchise was attacked, rates were cut, obstacles were put in the way of financing, and other troubles, large and small, constantly appearing, the building up of the business was no small task. The fight was carried on fiercely, but on account of the never-despair attitude of the West Side lighting people a foothold was secured. Later a third company entered the field and the fight was reopened, this time on a three-cornered basis, in a more severe manner than the original one.

The wonderful growth of Southern California has helped materially in building up the present extensive system from this small beginning, and with the careful handling of the business, from a financial and operating standpoint, capital was interested in sufficient amounts to take care of the increasing business and to acquire many other properties by purchase and consolidation. In the ten short years between 1896 and 1906, the business has expanded to such an extent that at present electric current is being furnished to twenty-two separate cities and towns and gas to eleven. All of the properties have been consolidated into the present Edison Electric Company, with a capital of $10,000,000 and an authorized bond issue in the same amount.

[1] Paper read before the National Electric Light Association, at Atlantic City, N. J., June 8.—Abridged.

THE WATER-POWER BEGINNING.

One of the companies taken over by the Edison Electric Company through consolidation was the Redlands Electric Light and Power Company, which was organized in July, 1892. At that time electric transmission of power was certainly in its infancy, if it could be said to have been born. The market demand for this power was so located as to render necessary the installation of a plant capable of transmitting power varying distances of from five to twenty miles, and equally well adapted for use in incandescent lighting, arc lighting and alternating-current motor service. The directors of the Redlands company were informed by their engineer that to make the plant a commercial success they should install a tri-phase system then in experimental use in Tivoli, near Rome. The first attempt to get the large manufacturing corporations to bid on this type of apparatus was unsuccessful, all claiming that the idea was too far in advance of practice for them to undertake it; but after a number of months' correspondence the General Electric and Westinghouse companies were induced to bid on specifications drawn by the Redlands engineer, and the apparatus was finally built by the General Electric Company. This plant, which goes under the title of "Mill Creek No. 1," on the Edison system, began operation in October, 1893, and is still in regular daily use, operating in synchronism with all water power and steam plants on the Edison system. As a legacy from this first plant, the company has still in use the first tri-phase generator, the first synchronous motor and the first induction motor ever put into commercial use by the General Electric Company.

The development of high-head water power on the Pacific slope in 1892 was in as experimental a condition as the transmission of electric power, and the promoters of the Redlands company installed their plant at the head of the valley without entering the cañon, as has since been the Edison company's universal custom. The power was generated by diverting the stream of Mill creek into a steel pipe thirty inches inside diameter, 7,250 feet long and having a pressure head of 360 feet. Later, this pipe was extended 3,000 feet further up the valley to the mouth of the cañon, giving a total net available head of 510 feet, under which the plant is now operating.

Three 250-kilowatt generators were finally installed in this station, current being generated at 2,200 volts stepped up through transformers to 10,000 volts, and transmitted to Riverside, a distance of twenty-eight miles, taps being made from Redlands and Highlands from the same line. Later, the voltage was raised to 33,000. The appliances, both hydraulic and electric, in use at that time were extremely crude as compared with the highly specialized types of construction in use to-day, and naturally the difficulties to be overcome were numerous. Nevertheless, while the plant is not as efficient as other plants on our system, it has furnished us in the past and is still furnishing us with a considerable amount of power, and since the first experimental stage was over, the cost of operation and maintenance of the plant has been small.

LATER POWER DEVELOPMENT.

While the development of a market for the power from the Mill Creek No. 1 plant was slow, each year showed the possibilities of electric power transmission, and in 1896 surveys were begun for the construction of a water-power plant in the Santa Ana cañon, using the water of Santa Ana river, on the other side of the mountains in which the Mill creek plant is located. It was expected that the plant would transmit approximately 4,000 kilowatts to Los Angeles, a distance of eighty miles. This plant was subsequently built and began operation in 1898, being what is now termed "Santa Ana River No. 1" plant of the Edison system. The type of hydraulic construction since adopted by the company was first used in this plant. Water is conveyed through a series of tunnels along the cañon walls, on a grade of approximately ten feet to the mile, to the head of a pressure main consisting of two steel pipes, each thirty inches inside diameter, 2,200 feet long, with a net effective head of 728 feet. The effectiveness of this type of construction has been thoroughly demonstrated by the fact that since the water has been turned into the tunnels it has never been turned off for any fault of the canal system, nor has any money whatever been expended thereon for repairs. The total length of canal line is approximately three miles, three-fourths of the way being driven through solid granite mountains. There are four three-phase, 750-kilowatt generators installed and the current is stepped up through air-blast transformers to 33,000 volts.

The growth of the business necessitating additional power, during the succeeding years several plants were constructed in the immediate vicinity of the first installations. Proceeding up the Mill creek

stream, the No. 2 plant, with a canal line of three and one-half miles, a water head of 620 feet and a capacity of 750 kilowatts, was the next plant put in operation.

"Mill Creek No. 3" was next constructed, with 1,960 feet head, seven miles of canal and a capacity of 3,000 kilowatts.

Then followed "Santa Ana River No. 2" and "Lytle Creek" plants, both having 560 feet head and capacity of 2,000 and 1,000 kilowatts respectively. The current is stepped up from all of these plants to 33,000 volts.

The total capacity of the six plants figures 10,500 kilowatts.

TRANSMISSION SYSTEM.

Everything on the system is connected in "Y" with the neutral grounded through two circuits of No. 0 hard-drawn copper wire. Some of the plants are located five or six miles from the main line. Plants are also on extreme ends.

The pole line carries two circuits of No. 0 copper a distance of about eighty miles to Los Angeles.

Substations are installed all along the line, in which the current is transformed and sent out on different circuits of 2,200, 10,000 and 15,000 volts. From the general distributing station in Los Angeles circuits are sent out to various substations located in and around the several beach towns, consequently we are delivering power from the mountains over a distance of 129 miles, almost in a straight line to the ocean, with numerous branches all along the line. The present transmission line figures a total length in 33,000 volts of 110 miles; in double circuit 10,000 and 15,000-volt transmission, 300 miles, and the 2,200-volt distributing systems in the several towns in which we are operating aggregate 750 miles. A great many difficulties have been encountered and overcome in perfecting this transmission system, an important one being the great distance we are from centres of manufacture. The growth of the business has been so rapid that it has seemed physically impossible to estimate the needs quite far enough ahead. This growth may in a way be noted from the fact that last year the peak load of the entire system increased ninety-four per cent over the peak load of the previous year. Insulator troubles have come up more or less frequently; an insulator good for 35,000 volts in the mountains would not stand up at 15,000 volts on the coast.

STEAM PLANTS.

In the general Los Angeles distributing station is installed 4,000 kilowatts in steam turbines, and we are just now installing an additional unit of 7,500 kilowatts, making a total of 11,500 kilowatts for the station. These machines have proven good for a fifty per cent overload. The installation at this station is of the very best, comprising remote control switchboard, motor driven switches, all concrete construction, and provision has been made for the distribution of 2,200 and 15,000-volt circuits and for the receiving of incoming circuits from the power plants, 33,000 and 66,000 volts. The 66,000-volt lines will be those of our new 20,000-kilowatt Kern river plant, which is nearing completion. In other parts of the system there are installed a number of small units feeding into the general transmission line, whose aggregate rated capacity is 4,000 kilowatts, good for some overload. All of the steam equipment is used as auxiliary for helping over the peak and for reserve in case of shorts or breakdowns along the line.

GENERAL OPERATING CONDITIONS.

The six hydraulic and seven steam plants, varying from an ordinary, old-fashioned Wheelock simple engine to a Curtis turbine, are run in multiple, feeding into the one general transmission system. A great many comments have been made and some wonderment expressed upon the surety of our service, operating under these conditions, but no serious disadvantages have so far been experienced.

The speed of the hydraulic plants is set at two per cent above normal, which guarantees their handling maximum load before any steam plants that are floating on the line cut in.

From six in the morning until midnight one of the 2,000-kilowatt turbines at Los Angeles is rotated as a motor, for the purpose of correcting the power-factor, and to cut in in case of trouble.

The success of this multiple operation depends first on the proper construction of the plants, and then on a thorough organization of the working forces, with fixed rules to govern fixed conditions. All stations are interconnected with a private telephone system.

The natural trend of the country suggests high-head power plants, as the streams, while containing comparatively small amounts of water, have natural falls of from 200 to 300 feet to the mile. All of these plants are as noted, high-head, but having in operation the Mill Creek No. 3 plant with its 1,960 feet fall, the lesser ones suffer in comparison.

Other than the use of extra care in devices at the intake for straining out all solid matter, the operation of a plant with 840 pounds pressure does not differ materially from that of 300 pounds pressure. When we consider that the spouting velocity of the water discharging through the pipe line of the No. 3 plant is 22,000 feet per minute, the necessity for this extreme care is apparent.

The low cost of operating water-power plants and the all-day load picked up in the vast area covered by the lines by reason of our ability to furnish power on very low rates, more than justify the extra investment in steam plants to insure the day service and carry the lighting load over the peak.

In many respects Southern California may be considered an ideal country for electric transmission and distribution. There is no doubt that the comparative freedom from windstorms, frost and sleet, with certain atmospheric conditions, helps materially. At the same time, there are few places in America where within a distance of twenty miles energy will be passing over lines enveloped in a snowstorm and through orchards covered with orange blossoms and surrounded with roses.

KERN RIVER.

Work is rapidly nearing completion on our first Kern river plant, designed to generate 20,000 kilowatts and transmit same at 75,000 volts a distance of 120 miles to Los Angeles receiving station. It is expected that within a few weeks the plant will be in operation. In this plant the hydraulic construction work consists of a masonry dam thirty-six feet high, anchored on bed rock, which forms a small lake or settling basin from which the water is turned into the canal, the flow being regulated by gates operated hydraulically. The canal consists of a series of nineteen tunnels eight and one-half miles in length, nine feet by nine feet in cross-sections, drilled through solid granite and lined along either side with a cement wall six inches in thickness, smoothly plastered and troweled, to give increased carrying capacity. These tunnels have a grade of 6.8 feet per mile and a water-carrying capacity of 450 second-feet. The water is discharged from the end of the tunnel into a small forebay to which is connected the intake of the pressure main. The pressure main consists of a circular inclined tunnel, having a slope of approximately seventy-six degrees to a point 200 feet from the power-house, where it changes to the same grade as the canal. This inclined tunnel has a riveted steel lining, 7.5 feet interior diameter, solidly backed with concrete between the lining and the outer walls of the tunnel. The

lining terminates where it leaves the tunnel at its lower end in ten branch pipes necessary for delivering water to the four generators and two exciters, under a net effective head of 865 feet.

In the concrete power-house will be installed four 5,000-kilowatt rated capacity, tri-phase generators, with extended shaft, carrying on each end one water-wheel. The combined output of the two wheels at each generator is 10,750 horse-power, capable of delivering from generator to switchboard a fifty per cent overload of the rated capacity of each generator. In addition there are two exciters, each 250 kilowatts rated capacity, equipped with water-wheels. The four banks of transformers will step the current up from 2,400 to 75,000 volts.

The 120-mile transmission line consists of a line of steel towers designed to carry three circuits of No. 0000 wire erected on a private right-of-way 100 feet wide. The two circuits will be used to carry the output of this first plant, the third to be strung later for carrying the output of a second plant immediately above the one now approaching completion.

The wide right-of-way will permit of the erection of an additional line of towers to transmit the output of other proposed plants on the Kern and Kings rivers.

The towers are constructed of angle iron, being twelve feet square at the base and varying in height from thirty to sixty feet, according to the nature of the country traversed. Both cross-arms are of ten-inch channel iron, the upper one being twenty-four feet long and the lower one eighteen feet. These towers are spaced, on an average, 700 feet apart on the level, and vary from that distance to 300 feet in hilly country. They are designed to stand the greatest strain that can be put upon them, and are both strong and graceful in appearance.

FUTURE POWER PLANTS.

The plans of the company contemplate the eventual construction along the Kern river of four water-power plants, in addition to the one now approaching completion. These plants are numbered on our records in order proceeding up the cañon, and with the several intervals between the intake of one plant and the power-house of the one above it, the plants will utilize the fall of the river for about eighty miles. The water head will vary from 340 to 1,200 feet, and will give a total output of 50,000 kilowatts at the ordinary low-water flow of the stream. The type of construction adopted for the No. 1 plant, with slight variations to meet the conditions of each particular plant, will be carried on throughout the work.

In addition to the Kern river, the company controls water rights, on which some little work has been done for an extensive system of water-power plants on Kings river, and other smaller plants on the Santa Ana river. After the completion of the Kern river plants it is probable that work will be proceeded with on these plants, and an additional capacity of nearly 60,000 kilowatts added to the system.

BOOK REVIEW.

"Report of the Electric Railway Test Commission to the President of the Louisiana Purchase Exposition." New York. McGraw Publishing Company. Cloth. 622 pages. 6½ by 9½ inches. 212 illustrations. Supplied by the ELECTRICAL REVIEW at $6.

This volume constitutes the report of the Electric Railway Test Commission, which was appointed during the Louisiana Purchase Exposition to take advantage of the large number of exhibits of electric railway apparatus at the exposition and to conduct tests and thus obtain a large amount of valuable engineering data. Recognizing this opportunity, the officials of the exposition appointed a commission to plan and supervise the work. This commission consisted of members selected from all branches of electric railway industry, and was made up of the following men: James G. White, H. H. Vreeland, J. H. McGraw, W. J. Wilgus and George F. McCulloch. The commission appointed an executive committee consisting of Professor W. E. Goldsborough, chief of the department of electricity of the exposition, and three superintendents—Messrs. H. H. Norris, B. V. Swenson and H. T. Plumb. The executive committee planned and carried out the tests, being assisted in this work by a corps of twenty-two men selected from the graduates of a number of universities. The commission decided to ask the cooperation, during the tests, of the American Street Railway Association. An invitation was sent and accepted, and several advisory and engineering committees were appointed, consisting of men well known in electric railway engineering. The work of the commission was materially assisted by the cooperation of the standardization laboratory of the United States Bureau of Standards in St. Louis, where the instruments used in the work were calibrated. The tests made at St. Louis extended over a period of five months, beginning about the middle of June. They include service, acceleration and braking tests on single and double-truck city cars, tests of a compressor station of a storage air system of car braking, tests of a storage battery locomotive for industrial purposes, determination of alternating-current losses in steel rails, and other steel and iron sections, and alternating-current losses in the track. In addition to these tests a series of service and acceleration and braking tests was made on an interurban car, on five miles of street track of the Indiana Union Traction Company's system. These tests were followed up by air and train resistance tests on a specially constructed air-pressure dynamometer car designed by the executive committee. During the latter tests data showing the effect of air pressure on vestibules and car bodies were obtained for speeds varying from twenty-five to seventy miles an hour, vestibules of different shapes being used during the tests. These tests showed very forcibly the large reduction which may be made in the power required to run the car by properly designing the front and rear vestibules. The report is divided into seven parts, part one being an introduction to the work. This introduction contains the suggested tests, as submitted to the commission by the various advisory committees. Part two gives the results of service tests of electric cars. It contains four chapters, the first being a general treatment of the subject and a description of the apparatus used. Chapter ii gives results of tests on the single-truck car, chapter iii of the double-truck car and chapter iv tests of an interurban car. Part three of the report deals with acceleration tests of cars, the types of car tested being a single-truck city car and an interurban car. Part four deals with the braking problem, and gives the results of tests of a storage air system of braking, braking tests on the double-truck city car equipped with air brakes, braking tests on an interurban car with air brakes, and braking tests on a single-truck city car equipped with magnetic brakes. Part five gives the results of tests of the storage battery industrial locomotive. Part six takes up the tests of alternating-current losses in iron and steel and in the track. Part seven deals with train resistance tests, the tests being made first with an ordinary interurban car, and then with the special test car Louisiana. Two appendices are included in the volume, the first giving general data relating to electric cars, and the latter acknowledgments to the various companies and institutions which cooperated in the work. The expense of the tests amounted to about $10,000, which was subscribed by the various individuals and electric railway companies interested.

THE AGITATION FOR MUNICIPAL OWNERSHIP IN THE UNITED STATES—ITS ORIGIN, MEANING AND PROPER TREATMENT.[1]

BY EVERETT W. BURDETT.

A spirit of unrest and discontent is abroad in the world. Although men are better off to-day than they ever were before, and industrial conditions are superior to any known in history, the masses and the working classes are arrayed against capital, and in some instances against the social order.

Great accumulations of wealth in the hands of a few, generally employed in corporate organizations, have so abused the privileges which wealth and organizations put at their disposal that the average citizen is disgruntled and inclined to demand a change of some kind which will tend to remove the inequalities of which he deems himself the victim. In short, a great socialistic agitation is upon us, which may result in far-reaching economic changes. Capital looks aghast at the armies of labor which are arrayed against it, and the working classes view the further accumulation of wealth and extension of corporation activities as a menace to their welfare. Socialistic doctrines are finding new adherents, and the professional agitator is winning new recruits.

To the forces which are professedly and violently socialistic have been added large numbers of persons, many well-intentioned, who, without consciously adopting the doctrines of socialism, are giving public affairs a decided impetus in that direction. They have seen great railroads exposed in giving secret rebates, which have enriched their recipients and impoverished the unfavored shipper. They have seen them employed to suppress competition in the products of the soil and the necessities of daily life. They have thus beheld the great highways of travel and of traffic, which ought to be open upon the same terms to all alike, turned into royal roads to riches for some and direct lines to the poorhouse for others.

They have witnessed enormous accumulations of cash and securities, in the coffers of life insurance companies, rightfully belonging to policy-holders and their beneficiaries, become, in the hands of corporate officials drunk with financial power and unchecked by adequate supervision or control, enormous corruption funds for any uses to which the whims of their managers may see fit to put them. Inflations of corporate capital, by consolidations and otherwise, to amounts which fairly stagger the imagination, and which a few years ago were not even dreamed of, have been made for no good purpose, but solely to enable promoters, bankers and speculators to make enormous initial profits, resulting in grievous additions to the permanent burdens, already heavy, under which the consumer and the general public must stagger for indefinite periods.

Necessary provisions of law for the raising of public revenues and a reasonable protection of American labor and capital from foreign competitions have, in many instances, been perverted for the unreasonable enrichment of the few at the undue expense of the many.

Corporate power has, in too many cases, been used to exact high prices for poor service, to secure enormous returns on fictitious capital, to pay extravagant salaries and support wasteful expenditures, to secure legislation to enrich the few at the expense of the many,—in short to further the interests of those wielding the power, to the detriment and destruction of those upon whom it has been exercised.

Forgetting the beneficent results which have been obtained only through the accumulation of great wealth derived from corporate organizations, the dissatisfied citizen sees only the abuses of financial and corporate power of which he has been, or imagines himself to be, the victim. The very word "corporation" has come to have an opprobrium of its own.

And yet, of course, this wholesale distrust and condemnation of wealth and corporate power is unreasonable. It loses sight of the fact that we are unable to assert from what other source the people at large would have derived the blessings which have come from the establishment and maintenance of the almost countless hospitals, libraries, colleges, parks, museums and special funds for the encouragement of learning, the promotion of science, the reward of courage and endeavor, and the various other beneficent uses for which they have been established and maintained by private wealth, largely derived from corporations. They forget that it has been only by the uniting of the funds of the rich and the savings of the poor in corporate organizations that the country has been developed by the establishment and exploitation of numberless forms of industrial enterprises, which have given employment to labor, activity and volume to trade, and a market for all the products of our soil and all the talents of our people.

In electrical enterprises the central station electric lighting investment alone already aggregates 700 million dollars, involving an annual operating expense of nearly or quite 100 millions, distributed among all classes of workmen and through every artery of trade. The census reports show that in the single year 1904 there was an output of new electrical apparatus of the value of more than 150 millions. There are nearly 5,000 central electric lighting stations. There are 23,000 miles of electric railway, carrying each year over 5,000 million passengers. A network of nearly 300,000 miles of steam railroad gridirons the country, transporting upward of 750 million passengers annually. Spoken words are transmitted through more than five million miles of wire, by the use of more than three million telephones, by which more than 5,000 million messages are transmitted yearly.

All these wonders we owe to our corporations. They have given free play to the enterprise and individual energy of our people, and have made that enterprise and energy vastly more powerful and effective than it otherwise could possibly have been. They have enabled the man of small means to do a part of the world's work by joining his savings with the capital of his wealthier neighbor. They have encouraged thrift and the spirit of investment. They have advanced civilization and brought to every man's door the diversified products of our own and other countries.

And it has been, not the organizers, managers and stockholders of these enterprises who have chiefly benefited by them, but the general public. It is unquestionably the fact that the public at large have, upon the whole, obtained vastly greater benefits from corporate enterprises than have those whose money has made them possible.

A glance at the net divisible incomes earned and the dividends paid by the electrical public-service corporations of the United States, contrasted with the character and extent of the service rendered by them to the public, will furnish ample demonstration of this assertion. Take the State of Massachusetts, for example; it has ninety-eight electric railways, operating 2,688 miles of track, transporting over 500 million passengers by the use of 7,341 cars. Only about one-third of them paid a dividend in 1905. Sixty-three paid no dividends at all, while the other thirty-five paid from two to ten per cent, with an average dividend of four and one-half per cent, which, if applied to all the companies in operation, would have yielded an average dividend of less than two and one-half per cent. At the same time these companies paid into the public treasury

[1] Abstract of an address before the National Electric Light Association, Atlantic City, N. J., June 8.

in the form of taxes nearly two million dollars.

In the same year there were in Massachusetts fifty-eight strictly electric lighting companies, only about one-third of which paid any dividends whatever. The dividends paid ranged from four to ten per cent. These companies paid into the public treasury in the form of taxes nearly $600,000. It thus appears that the tax-gatherer, the employé and the general public have each and all reaped rewards vastly greater than have been realized by the stockholders in these enterprises. But, fortunately, the conditions are improving; and even the disappointed investor begins to realize some reward for his courage in establishing and developing these industries. All tendencies are in the right instead of in the wrong direction, and are constantly diminishing the necessity, if it ever existed, of a change from private to public ownership.

But notwithstanding these improvements along all desirable lines of progress, I attribute the existing widespread agitation for the municipal ownership and operation of public utilities very largely to the influence upon the popular mind of the widespread dissatisfaction and resentment occasioned by the abuses of great wealth and corporate facilities, to which I have referred.

The politician, whatever his faults, can at least lay claim to a knowledge of human nature,—at any rate, that kind of uneducated human nature to which he principally appeals. He is therefore quick to seize upon the inevitable deficiencies in existing public services as an object of his disinterested criticism, and to make the most of them for his patriotic purposes. He it is, therefore, who is found preaching the beauties of municipal ownership in season and out of season, pointing out how wretchedly the responsible people now in control of quasi-public utilities are managing them, as compared with the ideal conditions which would prevail if he and his like were put in charge of them.

In pointing out the fallacy of adopting municipal ownership in this country on the strength of its alleged success abroad, the first thing which is to be suggested is the danger which always lies in the off-hand adoption of foreign methods, laws or practices in another country. It can seldom be done successfully. Differences in political, economic or social conditions almost always exist which render the transplanting of the laws, customs or methods of one country into another inexpedient.

As contrasted with American municipal service, that abroad is less political and more business-like in its character, more certain in its tenure, more continuous in its service and more disinterested in its activities. Its desirable features are not only secured and protected by law, but are demanded by public sentiment. While the raw material is perhaps as good or better in the United States than in the European cities, it is handicapped in its efficiency by its political character and the uncertainty of its tenure. The American municipal servant never knows how long he is to be permitted to hold his place and is subject to constant changes in policy and supervision. The only thing he can be reasonably sure of is that his head will ultimately drop into the basket. This system, for system it has come to be, may perhaps prevent dry rot and some of the evils of bureaucracy, but it is at the expense of efficient public service.

Time does not permit, and perhaps the occasion does not warrant, a careful or detailed statement of the particulars in which municipal ownership in Great Britain can be reasonably claimed to be a failure. A brief statement without arguments must suffice.

In the first place, it certainly has not resulted in any great financial profit. Official returns for the electric lighting undertakings of the kingdom to December 31, 1904, show that less than fifty-eight per cent of 182 municipal undertakings showed a profit, which averaged only about $4,000 for each undertaking, while ninety-two per cent of sixty-six private enterprises showed a profit, amounting on an average to more than $45,000 for each plant.

But the financial results are to my mind by no means the most satisfactory tests of the success or failure of municipal supply. If in all other important respects the results were favorable, a small profit or even an average loss might not condemn the enterprises. But when we find that whatever success has been attained has been accompanied with other results of the most baneful character, it may be well claimed that as was recently said by the London *Standard*, one of the most responsible of English journals, "municipal trading is a thing which, except in very rare instances, stands self-condemned."

That private enterprise can accomplish as good or better results than the public authorities in the field of the electric light and power, even in England, is amply demonstrated by the results in the cases (which are very few) where private enterprises have been allowed to operate under substantially the same legal conditions as the public plants. If tested by the indisputably sound economic proposition that the character of a public service is to be judged of by its extent quite as much as by its cost, British municipalities have woefully failed in the experiment of furnishing artificial light and power to their inhabitants. The five Scotch and English cities of Glasgow, Edinburgh, Manchester, Leeds and Birmingham combined have a smaller number of lamps installed than the single city of Chicago, not more than half as many as the city of New York, and barely more than the city of Boston, while their combined populations are considerably in excess of that of New York, about a million more than that of Chicago and five times more than that of Boston. If, as is indisputable, it is better service to supply 100,000 people in a given area with gas or electric light at a given price per unit than to supply half that number of people at half the price assumed, the British municipalities can lay no claim to success in the exploitation and prosecution of the business of public lighting.

But in one respect municipal ownership in Great Britain has been worse than a failure—it has been a calamity. Owing to the restrictive character of the laws, particularly the Electric Lighting Acts of 1882 and 1888 and the Tramways Act of 1870, the electrical industry in Great Britain has been hampered and restricted to such an extent as to make the showing lamentable. So serious had this become in 1902 that the council of the Institution of Electrical Engineers of England appointed a committee to "determine whether they can recommend the council to take an action, and if so, what action, that would assist the industry." After a most elaborate investigation and the taking of much testimony, the committee of the council resolved: "That, notwithstanding that our countrymen have been among the first in inventive genius in electrical science, its development in the United Kingdom is a backward condition, as compared with other countries, in respect of practical application to the industrial and social requirements of the nation." And this result was attributable principally to the operation of laws expressly designed to encourage municipal and discourage private enterprise.

The committee of the council of the Institution of Electrical Engineers expressly attributed the unsatisfactory results to the "restrictive character of the legislation

governing the initiation and development of electric power and traction undertakings and the power of obstruction granted to local authorities," which they alleged to be the "essential difference between the electrical industry as it exists in the kingdom and as it exists abroad."

Without pausing to refer to the increase of municipal debts and taxes, or the great argumentation of the army of municipal employés which have attended the development of municipal ownership in Great Britain and which have led many of its most thoughtful and patriotic citizens to regret the extent to which the practice has been carried and to attempt to restrict its further development, sufficient otherwise, appears to justify the conclusion that so far as municipal ownership and operation have been successful in Great Britain, that success has not been of such a character as to justify its being used as an argument for the trying of the experiment in this country.

Having attempted to state the origin, meaning and present status of the agitation for municipal ownership of public utilities in this country, I will endeavor in the few minutes left at my disposal to give in outline my idea as to the proper treatment of it.

The remedy for existing conditions must come from both within and without. The companies interested, the public authorities and the public at large must each contribute to the solution of the problem. None of them can or will be wholly effective without the others. Human nature is such that it can not be trusted to regenerate itself, public clamor is frequently ineffective, while enactments of the legislature can not accomplish all that is desired.

In the first place, the companies engaged in furnishing public services must, in their own interests, strive more and more to give good service at fair rates. While they can not all avail themselves of the advantages of the legal so-called "sliding scales," they can hope for the best results only along the line of the theory of the sliding scale. In my judgment, the time has gone by, if it ever was, when extortionate rates and wretched service will promote the interests of the corporations. He who serves the public best serves his company best. Patience and a spirit of conciliation, and a real desire to increase facilities and reduce charges as rapidly as consistent with such management, will ultimately bring their rewards in the form of increased earnings and larger dividends. And when the public, in any given community, comes to see that, notwithstanding the mouthings of the demagogue and the agitator, it is being fairly treated by the corporations, its objections to large and increasing returns upon invested capital will gradually disappear.

Next: the abuses of great wealth and corporate privileges to which I have alluded must cease, or at least be greatly mitigated. Self-interest must realize the fatality of a continuance of the abuses involved in gross over-capitalization, poor service, high prices, discrimination among consumers and above all the attempt to control the law-making power for purely selfish ends.

I do not include among these objectionable practices that reasonable inflation of capital necessary to induce men to start new enterprises, where, to offset the chances of loss, the possible amount of profit may reasonably be increased over that from ordinary investments. For such an inflation we have the warrant of the Supreme Court of the United States and a recent statement of President Eliot of Harvard, that much can be said in defense of it. The difference between such an inflation of new capital and the objectionable stock watering to which I have referred needs no elaboration. To insist upon the inviolability of private property, the freedom to contract or not contract with any man or set of men, the full rewards of individual initiative and personal endeavor and fair treatment for capital invested in corporate enterprises, is not only permissible but imperative; but to ignore the rights of others, to fail to recognize reciprocal obligations, to show a reckless disregard or contemptuous indifference for public sentiment is as unwise as it is discreditable. Capital must realize that there is a power greater than itself—the law—and that it is amenable to court more power than those constituted by statute, that of public opinion. I grant you it is often blind and unreasonable; if so, it must be educated and persuaded, not bullied or disregarded. While the agitator, the demagogue, the yellow journal and the other pestilential agencies which constantly assail corporate enterprises, must not be cajoled or tolerated, much less deferred to, "a decent respect to the opinion of mankind" is as fitting and as expedient in the business of the twentieth century as it was in the statecraft which evolved out immortal declaration of political independence.

Third. Public sentiment must be cultivated. The one great need in the economic world, as I view it, is popular education along sound economic lines. Let us no longer leave the exploitations of vital economic principles to the visionary or the doctrinaire, on the other hand, or to the irresponsible politician or selfish agitator, on the other. A real campaign of education is what is needed, a broad, comprehensive, intelligent, persistent, aggressive and well-directed campaign, which shall leave nothing in reason undone to spread sound economic doctrines. So far as self-interests enter into it, let it be an enlightened self-interest, having in mind the rights of all; let it be devoted to the fundamental proposition that all members of the community are bound together in such intimacy of relation that no member can ruthlessly injure another without ultimately feeling the recoil upon himself. "Live and let live," should be the motto.

Such associations as this can contribute greatly to a consummation so devoutly to be wished. I need not suggest the ways and means to you who are so much more familiar with them than am I.

State associations also can do much—particularly if imbued with a common purpose and subscribing to a common doctrine.

Time does not permit of the development of the suggestion; indeed that would require perhaps as much time as I have already occupied; but serious attention to it would, in my opinion, go far to achieve the results so much to be desired.

But as I have said, too much can not be expected from within. Human nature and human greed are such as to defeat the best intentions. At any rate, recent events in Washington have shown, if the assertion needed any verification, that the public will have a part, and a conspicuous part, in the attempt to bring about most satisfactory relations between public-service corporations and the communities they serve. The only question is, what form and direction will these efforts of the public take? The answer to that question depends, in my judgment, very largely upon the wisdom or folly of those who have the control of corporate enterprises.

Just now, the general tendency of the public seems to be to attempt to bring about improved conditions through the instrumentality of public ownership. I have attempted, though inadequately, to show that the experiment of public ownership, so far as it has been tried under conditions best calculated for its success, has

not produced results which encourage the belief that it offers a panacea for the ills complained of. On the contrary, it has been shown to involve results so detrimental as to more than offset the advantages claimed for it. And yet the community may turn to it, with a knowledge of its insufficiency as a choice of evils; if it acts on that ground, it will be largely the fault of the corporations. But, except as a choice of necessary evils, municipal ownership has no standing in the court of economics. It not only is not sufficient in itself to effect the results desired, but it is not the best means which can be employed for that purpose. I will venture to suggest the much better one from every point of view.

Richard Webster well termed, "the absolute necessity of inventive competition." It does not discourage personal enterprise and the combination of private capitals. It leaves the American theory of industrial freedom unharmed, but it controls so far as the public interests require. It enforces the right of the consumer and the general public, while recognizing the inviolability of private property and the inalienable right of the individual to industrial liberty. When nicely adjusted to the conditions to be dealt with, it operates to the advantage of all parties concerned—the consumer, the corporation and the general public.

Of course, this suggestion requires deliberate and ample consideration and elaboration,—wholly impracticable at the end of a paper already too ample in its proportions. But at least a concrete illustration, and what I claim to be a demonstration, of the soundness of the theory of public control, may here be given.

The State of Massachusetts has for twelve years been trying the experiment. It has developed a most complete system of public control of gas, electric lighting, railroad, street railway and other public-service corporations, and has just added the telephone industry to the others—the only one heretofore omitted.

While there are imperfections in the system, while both the corporations and the public are at times restive and dissatisfied with the application of it in specific cases, it has, in my belief, upon the whole, been an advantage to all concerned. It is by no means perfect; it might easily be made intolerable. But the sober sense of the people of Massachusetts, as represented in their legislative assembly, has prevented any gross perversions of its objects or confiscatory applications of its principles. The public is better and more cheaply served, the capital employed is more amply protected; the relations of producer and consumer are more satisfactory, than is the case in most if not all other portions of the country. The evils of stock-watering have been eliminated or minimized, while reasonable returns upon legitimate investments have been assured, if earned.

Such laws, unwisely framed or viciously applied, could do an immense amount of damage; but in the older of our communities, certainly, where the people at large are to be credited with a reasonable degree of intelligence and a real desire to secure a "square deal" for all alike, it offers, in my opinion, a vastly better solution of existing difficulties than does municipal ownership.

Single-Phase Equipment for Richmond & Chesapeake Bay Railroad Company.

In the early days of electric railroading, Richmond, Va., was among the first to install a street railway and in the year 1888 the Sprague system was installed and successfully operated in the city on a commercial basis. This glimpse of early railroad history is called to mind by the fact that Richmond is taking the same initiative by adopting the latest development in railway traction, the single-phase alternating-current system.

To this end the Richmond & Chesapeake Bay Railroad Company has been incorporated, and, in accordance with its plans, about fifteen miles of track will be equipped immediately with single-phase apparatus. Eventually this single-phase road will extend from Richmond to Chesapeake, but the portion about to be electrified comprises that part lying between Richmond and Ashland. The contracts for the equipment of this section have been let to the General Electric Company.

The line in general will follow the plans which several roads in the middle west have adopted, but the trolley voltage will be higher. The catenary method of suspension will be used, adapted for a trolley potential of 6,600 volts. Each of the cars will be equipped with four GEA-603-(125) alternating-current single-phase motors. Multiple-unit control will be furnished using the Sprague-General Electric system. The air-brake system will be of the combined straight and automatic type with CPA-52 motor compressors.

Power for the operation of the new road will be furnished by the Virginia Passenger and Power Company and the arrangements for furnishing the single-phase current are of especial interest. Two generating sets will be furnished, both to be operated ordinarily by water power, but arranged for electrical drive when that is necessary. The first unit will consist of a 750-kilowatt, 6,600-volt, three-phase, twenty-five-cycle generator, mounted on the same shaft with a 750-kilowatt, 2,300-volt, sixty-cycle, three-phase generator, the shaft being extended at one end for connection with a water-wheel of sufficient power to drive both generators at their rated output.

The second set will be made up of a twenty-five-cycle, 6,600-volt generator, a duplicate of the first, but instead of being mounted with a sixty-cycle machine, this generator will be mounted on the same shaft with a 750-kilowatt, 550-volt, direct-current machine. When there is sufficient water to operate all of the water-wheel generators in the station, these sets will be driven by the water wheels; if at any time there is insufficient water to drive the generators or flood conditions render it advisable to close the gate valves, the sets will be disconnected from the wheels and operated as straight motor-generator units. In their respective cases, the sixty-cycle generator will run as a sixty-cycle synchronous motor and the 550-volt machine will operate as a direct-current motor. Power for driving the motor end of the twenty-five-cycle sets in this way will be obtained from the engine-driven units of the Virginia Passenger and Power Company already installed. When the motor-generator units are operated as water-wheel driven machines, the sixty-cycle generator will be operated in parallel with the present sixty-cycle machines, and the 550-volt machine in the other set will run in multiple with the present 550-volt machines. The 750-kilowatt, twenty-five-cycle generators in each set will for the present be operated as single-phase machines and will supply current directly to the trolley of the Richmond & Chesapeake road at 6,600 volts.

In addition to the main apparatus outlined for the road, there will be a lighting station at Ashland. This will consist of a 100-kilowatt, 2,300-volt, sixty-cycle, three-phase generator mounted upon a common base with a 150-horse-power, 440-volt, twenty-five-cycle, single-phase induction motor. This set will be operated from the 6,600-volt trolley through a 150-kilowatt, single-phase, oil-cooled transformer. The motor-generator set will be provided with a direct-connected exciter mounted on an extension of the shaft. The voltage will be controlled by a Tirrill automatic regulator, made by the General Electric Company, which will insure a uniform voltage at the generator end of the lighting service regardless of the fluctuating trolley voltage.

The Richmond & Chesapeake Bay single-phase electric road will practically parallel the Richmond, Fredericksburg & Potomac steam road from Richmond to Ashland and it is the intention of the trolley company to maintain a fast schedule between these two points, operating cars at very frequent intervals.

The Rotary Converter Substations of the Long Island Railroad.

By W. N. Smith.

IN FORMER articles there have been described, first, the main power station[1] which furnishes electrical energy for train propulsion on the Long Island Railroad, and, second, the power-transmission line.[2] Attention is now invited to the general scheme of power distribution to the several railroad lines, through rotary-converter substations.

The central position of Woodhaven Junction led to its adoption as the principal distributing point for the high-tension circuits, the main trunk line of the transmission system being brought to that point from the power station. This particular substation is, therefore, somewhat more complicated and makes use of somewhat heavier apparatus than is required in most of the other substations. For this reason the Woodhaven Junction substation will be referred to hereafter somewhat more in detail than the others, particularly as regards the switching equipment.

The distances from Woodhaven to the various substations are as follows: East New York, 3.2 miles; Grand avenue, Brooklyn, 6.2 miles; Rockaway Junction, 3.4 miles; Hammel, 7 miles. Belmont Park is distant from Rockaway Junction 3.5 miles. Springfield Junction is distant from Rockaway Junction substation 3.4 miles. The branch feeder lines to the portable substations located at the latter points are manipulated from Rockaway Junction, where they can be thrown to one or both of the two main transmission lines which connect Rockaway Junction substation with Woodhaven Junction substation and Long Island City.

The principal feature of each substation is its equipment of rotary converters and transformers. In a single instance, namely, at Hammel, a storage battery of 3,200 ampere-hours capacity at the one-hour rate at 600 volts, with two boosters of 162-kilowatt capacity each, was installed as an adjunct to the substation machinery. The location and arrangement of all the substation buildings are such as to enable the ultimate use of a storage battery should future conditions justify it, and the apparatus in each building is so laid out that if the storage battery should be installed the necessary boosters can occupy the space allotted to one rotary converter.

[1] ELECTRICAL REVIEW, vol. xlvii, No. 19. Vol. xlviii, No. 14 and No. 15

[2] ELECTRICAL REVIEW, vol. xlviii, No. 23.

The substation equipment also includes the two portable substations mentioned above, each consisting of a car containing one 1,000-kilowatt rotary converter, three 375-kilowatt transformers and the necessary blower and switchboard panels, high-tension oil circuit-breaker and connecting leads to the outside circuit-breakers.

Station.	Rotary Converters. Kw.	Transformers. Kw.	Boosters. Kw.	A.-C. Feeders.	D.-C. Feeders.
Grand Avenue:					
Present installation....	3—1,000	9—375	.....	2	5
Ultimate capacity.....	5—1,500	15—550	.....	4	11
East New York:					
Present installation....	3—1,000	9—375	.....	5	6
Ultimate capacity.....	4—1,500	12—550	.....	12	16
Woodhaven Junction:					
Present installation....	3—1,500	9—550	.....	12	10
Ultimate capacity.....	6—1,500	18—550	.....	18	18
Rockaway Junction:					
Present installation....	2—1,000	6—375	.....	4	6
Ultimate capacity.....	4—1,500	12—550	.....	11	16
Hammel:					
Present installation....	2—1,000	6—375	2—162	2	6
Ultimate capacity.....	5—1,500	15—550	2—162	5	13

Besides the rotary converters, transformers and battery apparatus listed in the foregoing table, there is in each substation the requisite equipment of minor auxiliary apparatus.

The substation buildings are of a uniform type of construction throughout, excepting at Grand avenue, where the reduced area of the lot made its adoption impracticable. This type consists of a central section of about fifty-one feet span, which is wide enough to accommodate two 1,500-kilowatt rotaries and the necessary transformers. The central space is flanked on each side by a narrow section, that on one side being devoted to high-tension bus-bars and switch gear, while that on the other side contains the low-tension switchboard and operating gallery.

All of the substations except Woodhaven Junction received an initial equipment of 1,000-kilowatt rotary converters. The machine foundations and general interior arrangement are, however, such as will accommodate a complete outfit of 1,500-kilowatt units at all stations, should traffic requirements in the future make it necessary to fill the buildings with apparatus to their utmost capacity.

Each substation is served by a 16-ton Niles crane, hand-operated from its trolley, thus obviating the usual hanging chains. It spans the central bay and it is available not only for handling the permanent heavy substation machinery, but also the apparatus of the portable substations, which (excepting at Grand avenue) can be run under it upon a track that enters one of the end bays of the building.

Substation No. 1, at Grand avenue, is located in the built-up section of Brooklyn, and its interior arrangement was therefore modified to conform to the available ground area. The building consists of a series of bays carrying the crane girders, which traverse the building lengthwise from front to rear. The switchboard gallery is installed at the rear end instead of on the sides. The switching equipment, being somewhat simpler than that at other stations, was more easily taken care of in the reduced space, and the basement was utilized for the high-tension bus-bars, so that only one gallery was needed above the main floor.

The position of the building in the lot is such as to provide room for the construction of a battery house in the future should it ever be needed. The building itself is fifty-two feet eight inches wide and sixty-six feet deep.

The rotary-converter foundations are arranged in two lines, from front to rear, with room enough for the accommodation of five 1,500-kilowatt machines, should that amount of rotary capacity ever be required. The transformers are placed in banks along the side walls.

Substation No. 2, at East New York, is situated at the southeast corner of the intersection of the Atlantic and Manhattan Beach divisions—on railroad property large enough to afford room for a possible future extension of the building should it ever be desired to install storage batteries. This building is of the standard type of construction, three bays in length.

A side track enters the station, the first bay providing space enough to permit the entrance of a portable substation, which can thus be coupled up with the apparatus

at this station if required. This track was also of material assistance in unloading the apparatus into the substation during construction. The location of East New York substation is such as to preclude the possibility of overhead high-tension line construction and consequently all arrangements for entrance and exit of high and low-tension feeder cables are through a vault in the basement. As two sets of alternating-current bus-bars are required at this station, the high-tension gallery is built to the maximum width.

Substation No. 3, at Woodhaven Junction, is similar to that at East New York, but has an additional story over the high-tension gallery to accommodate the entrance and exit of the incoming feeder trunk lines from the main power station, and the outgoing line to Hammel. This station is also longer than No. 2, consisting of four bays instead of three, which will enable it to ultimately accommodate six 1,500-kilowatt rotaries instead of four. The high-tension section is of the maximum width to permit the installation of two sets of high-tension bus-bars.

The building is also provided with a track entrance for the portable substation. It stands on railway property of sufficient size to accommodate a battery house immediately in its rear, should one ever become necessary.

Substation No. 4, at Rockaway Junction, is also of the standard construction, comprising three bays in its lengthwise dimension. At this station all the high-tension circuits are overhead, necessitating the upward extension of the high-tension gallery into a lightning-arrester chamber of the same type as at Woodhaven. The portable substation houses at the two race-tracks are supplied with high-tension current through this station, which, as a distributing point, thus requires two sets of bus-bars; so that the high-tension gallery of this station is of the same width as at Woodhaven and East New York.

Substation No. 5, at Hammel, comprises a main substation building of the above-described typical construction, four bays deep, and a storage-battery house. The entrance and exit of feeder cables is underground at this station because it is too short a distance from the Beach Channel drawbridge to make it worth while to change from underground to overhead transmission. The fact that no transfer bus is required in this station permits the high-tension gallery section to be narrower than that in stations Nos. 2, 3 and 4.

This building is supported by a pile foundation consisting of about 900 piles, twenty-five feet long, which were put down by means of a water jet and hammered to a good bearing.

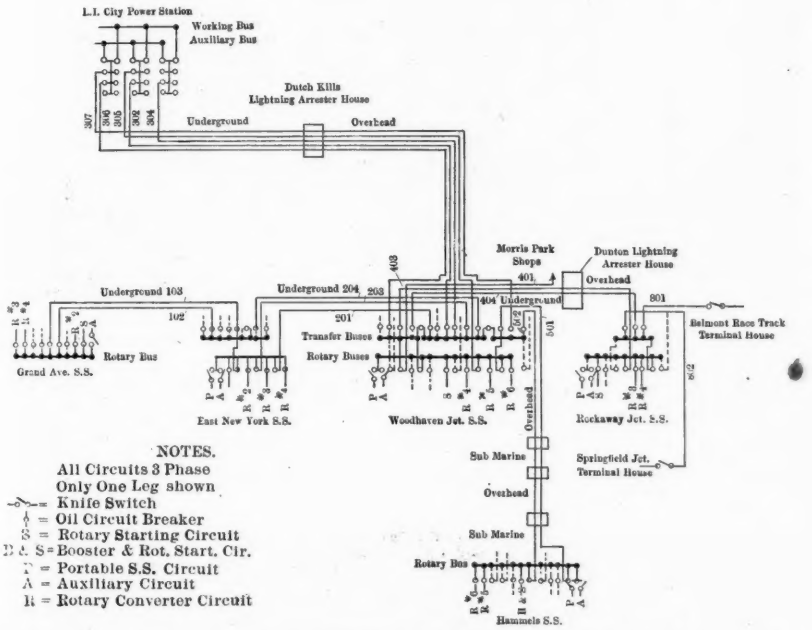
The substation building is seventy-eight feet ten inches by sixty-nine feet four inches outside. The battery house, which forms an extension of it, is 101 feet eight inches by sixty-three feet. This battery building is of special reinforced-concrete construction throughout, there being no exposed metal used in any part of it. It is a one-story structure with side walls about fifteen feet high surmounted by a low parapet, and having a monitor roof about fifteen feet wide and about six feet in height running the entire length of the building at the centre.

There are eight rows of battery tanks in the building, and to properly support them there was provided under each row of tanks a grillage running the length of the building, composed of four six-by-six-inch yellow-pine stringers, resting upon ten-by-ten yellow-pine cross-ties four feet eight inches long, spaced at intervals of two feet two and three-quarter inches between centres. These were laid in a bed of cinders and were filled around with cinders up to a little above the bottom of the stringers. The aisles between the rows of stringers were paved with hard-burnt paving brick laid on edge.

The use of air-blast transformers requires special provision for the air ducts which carry the air supply to them from the blowers. One large air duct is formed by so disposing the foundations of the rotaries as to make a separate compartment in the basement surrounding the rotary converter foundations on three sides into which air is forced by the blowers. The transformers are set over openings in the main floor which constitutes the top of the air duct. There is ample space to permit of easy access to the transformers underneath, and room enough for the workmen to move about freely in the duct. It is entered through a fire-proof door opening into it, which is sealed against the air pressure of one ounce per square inch maintained in the compartment, when the blowers are in operation. The cable connections to and from the transformers are carried into and out of this chamber through air-tight bushings.

The portable substations, while being used at the race-tracks are housed in buildings especially designed to accommodate them. The buildings are located at Belmont Park and Springfield Junction, and are each eighty-eight feet four inches long, and seventeen feet wide over all, with a tower at the end opposite the entrance, about thirty-six feet in height, for the purpose of affording a convenient entrance for the high tension cables and providing an enclosure for the high tension lightning arresters. Each building can accommodate two portables.

The track is a little at one side of the centre of the building, affording room for a plank platform about three feet wide to run along inside the wall for the full length of the building at a height even with the floor of the portable substation car, affording convenient access from one



LONG ISLAND RAILROAD ELECTRIFICATION—OUTLINE DIAGRAM OF CIRCUITS BETWEEN POWER-HOUSE AND SUBSTATION.

car to the other, and to the chamber at the base of the tower, whose interior is reached by an iron ladder running up from the platform.

The electrical machinery in the substations is all of Westinghouse manufacture.

The rotary converters are of the two-bearing type with field frames divided in a horizontal plane. Each converter is provided with a starting motor, whose frame is mounted upon an extension of the base of the rotary converter. The base frame is set into the floor so that the top of it is level with the floor line. It is entirely open below the commutator so that there is easy access to the lower brushes from the pit in the interior of the foundation, which can be easily reached from the basement.

The 1,000-kilowatt rotaries are rated to deliver 1,600 amperes at 625 volts, and 1,667 amperes at 600 volts. The three-phase potential at the alternating end is approximately 370 volts, for 625 volts at the direct current end. The 1,000-kilowatt machines have eight poles and operate at 375 revolutions per minute corresponding to a frequency of twenty-five cycles per second.

The 1,500-kilowatt rotaries are rated to deliver 2,400 amperes at 625 volts, or 2,500 amperes at 600 volts. They have twelve poles and run at 250 revolutions per minute.

In nearly all respects the two sizes of machine are very similar. The fields are compound wound with the shunt winding arranged for self-excitation. The machines are so over-compounded, that if operated as direct-current generators at constant speed, the voltage will rise from 600 volts at no load to 650 volts at full load.

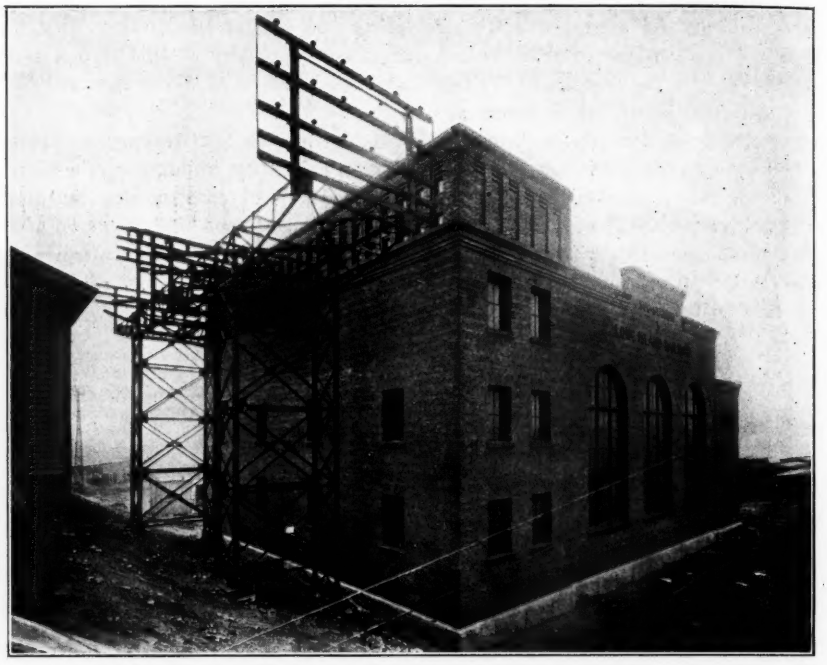
The starting motor is powerful enough to bring the armature from rest to or above synchronous speed in thirty seconds. The total weight of the 1,000-kilowatt rotary is about 50,000 pounds and of the 1,500-kilowatt rotary about 81,000 pounds. The rotary converter efficiencies at or above ninety-five per cent power factor is as follows:

	1,000-Kilowatt. Per cent.	1,500-Kilowatt. Per cent.
Efficiency at half load.....	94.25	94.75
Efficiency at full load.....	96.0	96.65
Efficiency at 25 per cent overload	96.25	97.0

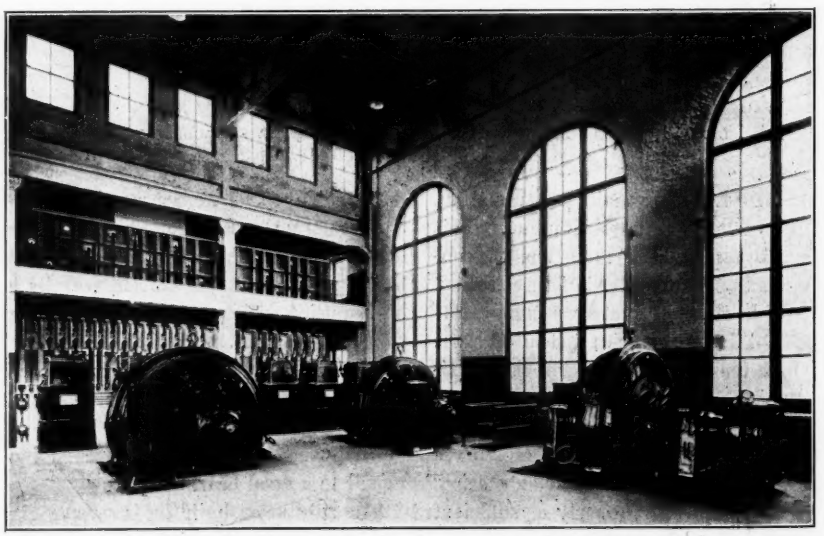
The transformers used with the converters are of the air-blast type throughout. Those for the 1,000-kilowatt rotary converters are grouped in banks of three 375-kilowatt transformers to one rotary converter. For the 1,500-kilowatt converters they are in groups of three 550-kilowatt each.

They are of the shell type of construction, with the cores built up of sheet steel of high magnetic quality carefully annealed to prevent aging. Each transformer is mounted in a cast iron housing arranged for receiving air at the base and discharging it at the top and side. Removable panels are fitted into the housing which permit of easy access to the core for inspection and cleaning. Access can also be had to the coils from the air chamber underneath. There is a damper at the top of the housing to regulate the air for cooling the coils, and one on the side for controlling the air that ventilates the cores.

The high tension winding is designed for a normal electromotive force of 12,000 volts with taps arranged to enable other voltages to be utilized down to 10,000 volts. The low-tension winding is designed to normally carry 400 volts with taps which will enable other voltages to be taken off it down to 340 volts. The high-tension terminals are at the top of the transformer. The low-tension leads are brought to suitable terminals in the bottom of the transformers. The transform-



Long Island Railroad Electrification—Exterior of Woodhaven Junction Substation.

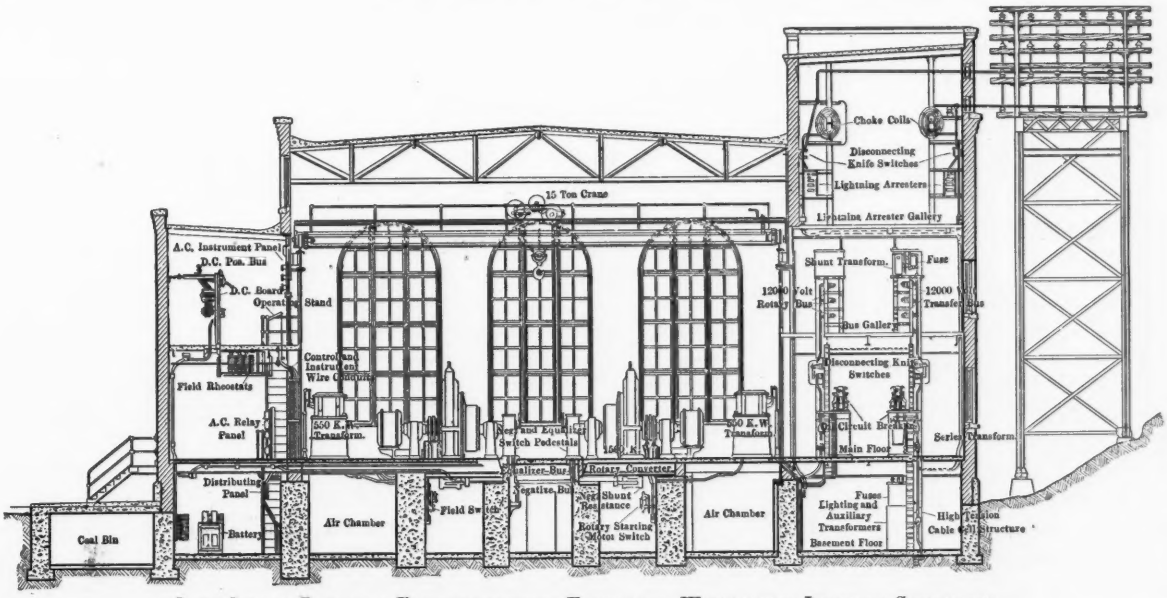


Long Island Railroad Electrification—Interior of East New York Substation.

er efficiencies, based on normal kilovolt-ampere rating, 12,000 to 400 volts is as follows:

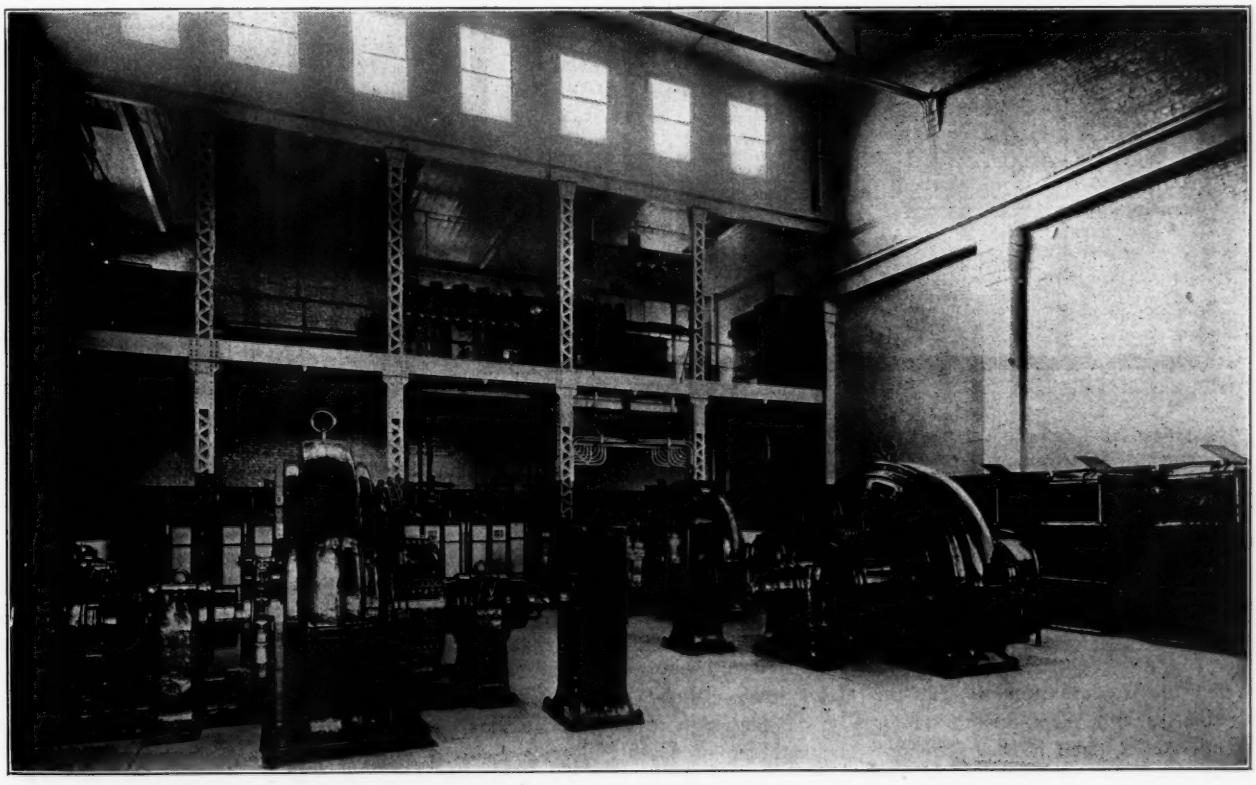
	375-Kilowatt. Per cent.	550-Kilowatt. Per cent.
One-half load	96.3	96.8
Full load	97.2	97.6
Fifty per cent overload	97.1	97.45

The transformers are designed for a high reactance electromotive force to permit the compounding of the rotary converters. This reactance electromotive force is about nine per cent of the entire impressed electromotive force. The resistance volts is about 1.35 per cent.



LONG ISLAND RAILROAD ELECTRIFICATION—ELEVATION, WOODHAVEN JUNCTION SUBSTATION.

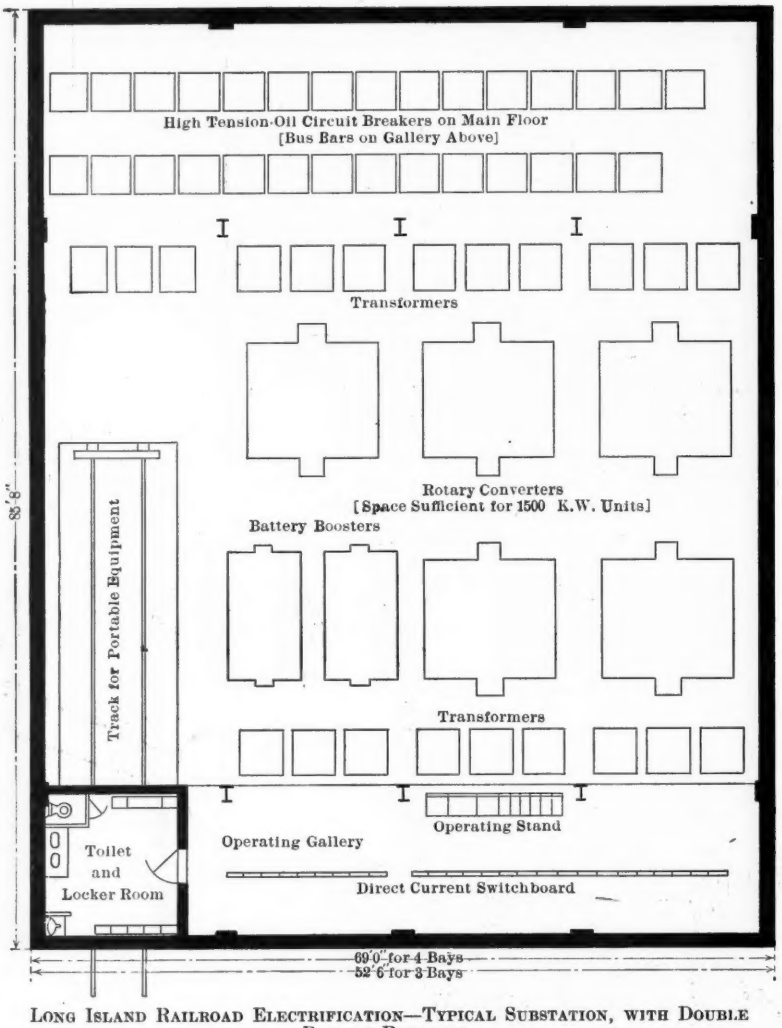
At substations Nos. 1, 2, 3, and 4, where there are no storage batteries, a group of three auxiliary transformers is employed to furnish current for the starting motors of the rotary converters. These are of fifty kilovolt-ampere capacity each, the bank being able to start up and synchronize three 1,500-kilowatt rotary converters simultaneously, and are of the oil-insulated self-cooling type, reducing the three-phase, twenty-five cycle current from 12,000 to 400 volts. They are placed in a row on the main floor and are connected to the rotary bus by an automatic oil circuit-breaker, electrically operated from the main control stand.



LONG ISLAND RAILROAD ELECTRIFICATION—INTERIOR OF GRAND AVENUE SUBSTATION.

At substation No. 5, where a storage battery is employed that involves the use of two 162-kilowatt booster generators each

driven by a 235-horse-power induction motor, there is provided a bank of three 200-kilowatt air-blast transformers, affording sufficient capacity not only for operating the battery boosters under the maximum conditions of load but also for simultaneously starting one rotary converter without dropping the secondary voltage of the transformers sufficiently to affect the booster regulation. These transformers are of the air-blast type, and their mechanical



LONG ISLAND RAILROAD ELECTRIFICATION—TYPICAL SUBSTATION, WITH DOUBLE ROW OF ROTARIES.

and electrical design corresponds very closely to that of the larger transformers that supply the rotary converters. These transformers are set on the main floor over the air ducts for the main transformers and in line with the latter.

Two 7.5-kilovolt-ampere transformers connected in "V" are provided for the blower motors and the induction motor which operates a small booster generator used for charging the auxiliary storage battery that furnishes current for the electrically-operated switch control system. At Woodhaven Junction these are of 10-kilowatt capacity. Three transformers are of the oil-insulated type, with the windings placed in substantial sheet iron cases, with cast iron top and base. The transformation is from 12,000 to 400 volts.

For supplying the house lighting circuits there is also provided a single transformer, which at Woodhaven and at Hammel is of fifteen kilovolt-ampere capacity, and ten kilovolt-ampere capacity at the other stations. This is also of the oil-insulated type, transforming from 12,000 down to 210 and 105 volts for a three-wire system.

The storage equipment installed at Hammel substation, with its auxiliaries, is made up as follows: The battery itself comprises 306 elements of the Electric Storage Battery Company's chloride accumulator, each element containing fifty-five type R plates, in regular service. At the temperature of seventy degrees Fahrenheit, they have the following capacities:

Rate. Ampere.	Time. Hours.	Capacity. Ampere-Hours.
700	8	5,600
1,000	5	5,000
1,500	3	4,500
3,200	1	3,200

The normal rating of the battery is the one hour, for which time it can discharge at the rate of 3,200 amperes. In case of necessity, however, there is sufficient capacity in the battery to discharge at the rate of 6,400 amperes for a space of twenty minutes. For instantaneous fluctuations it can discharge up to a momentary maximum rate of 9,600 amperes or three times the one-hour rate.

The tanks are insulated from the floor by two tiers of single-petticoated glass insulators. The upper tier consists of eight insulators per tank, resting on four yellow-pine stringers substantially braced crosswise.

To properly effect the charging and discharging of the battery when used as a regulator for the rotaries, there are two direct-connected, motor-driven, separately excited boosters, each consisting of one three-phase induction motor and one direct-current generator mounted on a common bedplate. The booster generator is rated to deliver 1,300 amperes at 135 volts continuously, with a rise of temperature not to exceed forty degrees centigrade above the temperature of the surrounding air. It has an overload capacity of 1,600 amperes for one hour, of 3,200 amperes for two minutes. Two of these boosters in parallel are required to take advantage of the full discharge rate of the battery.

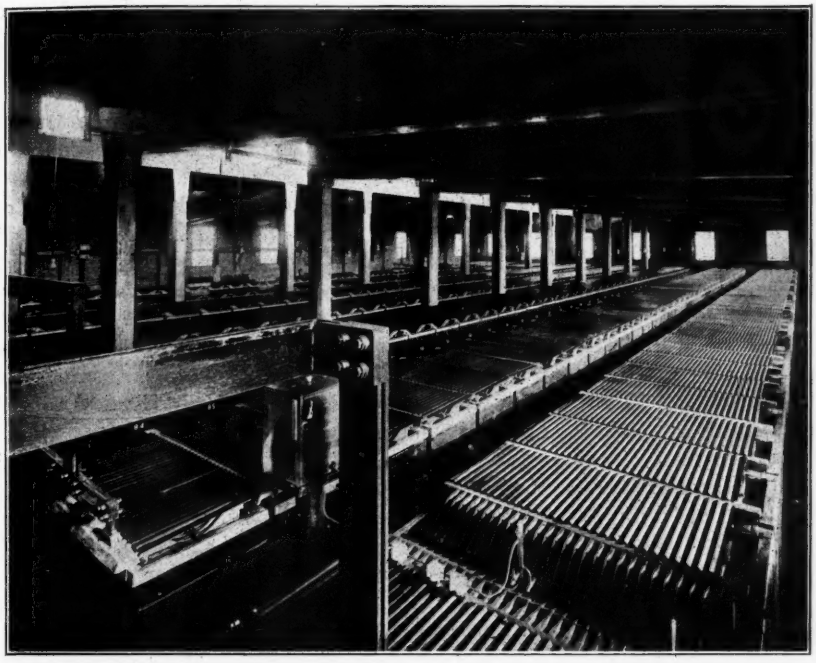
In order to use the battery to maintain a comparatively steady load on the rotary converters, the boosters which are in series with the battery and the third-rail circuit must have their magnetic field excitation changed, both as to intensity and as to polarity, by an amount that will cause the boosters to either charge the battery from the rotaries or when reversed, to discharge it into the third-rail circuit; and they must effect this regulation as nearly as possible instantaneously with the fluctuations as they actually occur in the system.

This is accomplished by means of a small booster exciter generator driven at a constant speed by an induction motor.

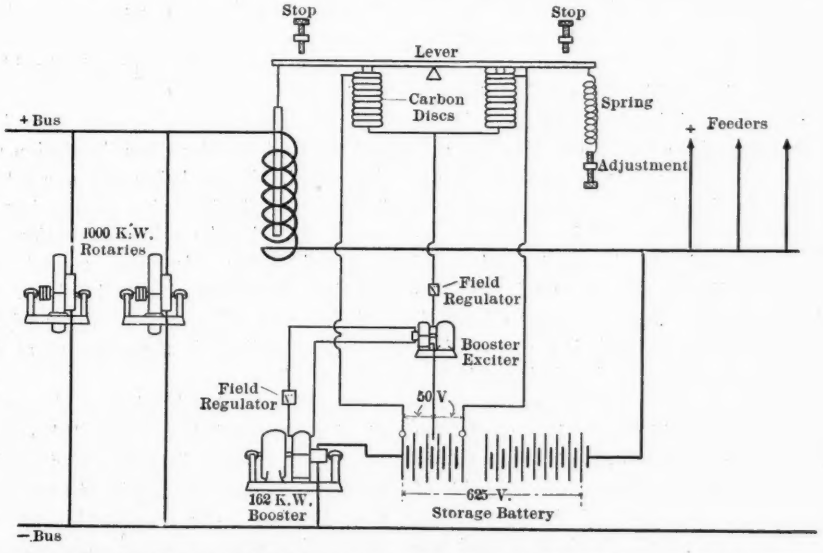
The booster is in series with the battery across the 600-volt station bus-bars. From the opposite ends and from the middle point of a section of 100 cells of the storage battery, three circuits are led, one of which passes through the field of the small exciter to a connection that joins together two piles of carbon disks which are subject to the pressure of a lever. The outer end of one carbon pile is then connected to one of the wires leading to the positive pole of the 100-cell section of storage battery, and the wiring from the

outer end of the other carbon pile is joined up to the negative end of the 100 cells. The circuits are thus formed, each including a separate half of the battery section and one carbon pile, while both have a common connection from the centre of the battery section, which passes through the field of the little exciter. The resistances of the two carbon piles, when subjected to equal pressures, are equal, and current will then flow from the battery through both carbon piles and back to the negative pole of the battery, there being then no tendency for any current to flow from the central point of the two-carbon resistances back to the central point of the battery or vice versa, through the field of the small exciter.

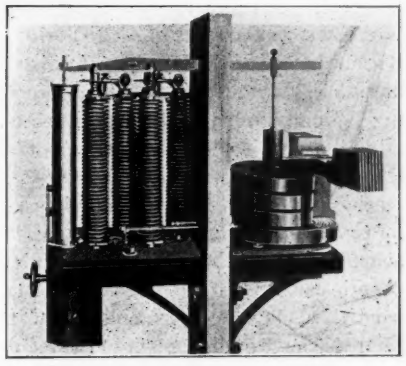
The lever which bears upon the tops of the two carbon piles is balanced upon a knife edge, and from one end of it is freely suspended the soft iron core of a solenoid, through the coil of which passes the entire output of the rotary converters. To the other end of the lever is attached a helical spring whose tension may be adjusted by hand to counterbalance the pull of the solenoid at any desired load on the machines. Slight variations of load above or below this amount will, through the action of the suspended core of the solenoid, cause changes in pressure on the carbon piles by means of this lever, which results in wide variations in the contact resistance in the carbon piles. The pile that is compressed through the action of a small increase of current in the solenoid will have its resistance reduced, and more current will flow through it than through the other one upon which the pressure has been simultaneously released. If the carbon pile thus pressed, happens to be the one whose outer end is attached to the positive pole of the battery section, for instance, the current will flow from the positive terminal of the battery around through the compressed pile and through the booster exciter field to the middle point of the battery, inducing polarity in one direction in the booster field to an extent corresponding to the increase of current that caused the solenoid to compress the carbon plates. When the current in the main circuit is slightly reduced, the solenoid action is reversed, pressure on that particular pile is released, and the other carbon pile whose outer end is coupled to the negative pole of the battery section, is compressed, the current in the regulator circuit flows from the middle point of the battery back through the booster exciter field in the opposite direction, and through the other pile to the negative pole of the 100 cells. The booster exciter field is thus reversed, which reverses the polarity of the booster field, and consequently the polarity of the booster itself, finally resulting in the reversal of battery action. The action of the regulator is somewhat analogous to that of the Wheatstone bridge.



LONG ISLAND RAILROAD ELECTRIFICATION—INTERIOR HAMMEL SUBSTATION (BATTERY ROOM).



LONG ISLAND RAILROAD ELECTRIFICATION—DIAGRAM OF CONNECTIONS WITH CARBON REGULATOR FOR STORAGE BATTERY AT HAMMEL SUBSTATION.



CARBON REGULATOR FOR STORAGE BATTERY.

This carbon regulator for automatic booster control was designed and manufactured by the Electric Storage Battery Company, of Philadelphia. The small exciter for the storage battery booster is of special design on account of the peculiar work demanded of it. It is of capacity

sufficient to excite the fields of both booster generators when operating continuously. In order to quickly overcome the counter electromotive force of induction and thus enable the booster to pick up its load quickly, the exciter is able to give a voltage considerably in excess of that required for a steady maximum booster excitation. As the booster generator responds to this exciter, the retrograde action of the regulator automatically reduces the excitation of the exciter. The exciter is driven by an induction motor wound for three-phase, twenty-five-cycle current at 400 volts, provided with an auto starter. The two machines are mounted on a common bedplate.

In the initial installation all high-tension feeders are run in one trunk line from the power station at Long Island City to Woodhaven Junction. From this substation, three general branches of the transmission line are run, one westward to East New York and Grand avenue, one eastward to Rockaway Junction, to the two portable substation terminal houses, and to Valley Stream and one south to Hammel. Two other substations besides Woodhaven, namely, East New York and Rockaway Junction, each have to distribute alternating current to feeders supplying the outlying substations near the terminals of the railway system. At these three principal substations, therefore, the scheme of connections was so designed as to provide flexibility in shifting feeders about among all the substations. This is done by an extra set of bus-bars suitably subdivided into sections and called the "transfer bus" in distinction to the regular working bus-bars of the station which are hereinafter referred to as the rotary bus.

The rotary bus in each station receives current directly through a feeder independently of the transfer bus in that particular station. This enables high-tension current to be passed through an intermediate substation to one or more beyond, independent of the operation of apparatus in the former.

The transfer bus is sectioned by non-automatic oil circuit-breakers so that all branches can be run separately or together as desired. A separate feeder connection to the Woodhaven rotary bus as well as the other bus connecting switches enables the Woodhaven rotary bus to be coupled to either of the three sections of the transfer bus.

The general arrangement at East New York, and Rockaway Junction substations is similar to that at Woodhaven, but considerably simpler, as less apparatus is required in the initial installation at those two stations. In the ultimate installation it is planned to have main feeders run direct from the Long Island City power station of the Pennsylvania Railroad Company to each of these three principal substations. The feeders now connecting to these transfer buses will then be available as relays.

The disposition of the high-tension switching apparatus varies slightly at the different substations due to the considerations mentioned above. The most complete development is at Woodhaven Junction substation on account of its position in the system.

The high-tension cables enter through the lightning-arrester gallery in the third story. The cables are then carried down the wall into the basement, where they cross to septums built into the back of the brick cubicles enclosing the oil circuit breakers on the main floor of the high-tension gallery. This bank of oil switches is directly underneath the transfer bus and controls all the circuits that enter and leave the bus. The incoming cables of each circuit, therefore, run first to the proper oil switch, continuing thence up to the transfer bus in the gallery overhead, each cable being run in a separate brick septum. The outgoing branch circuits are tapped out of the transfer bus, each tap coming down a septum in the back wall of the bus structure, to oil switch directly underneath. The oil switches both for the incoming and outgoing circuits are all in the same line underneath the transfer bus on the outer side of the gallery.

On the inner side of the gallery the station or "rotary" bus-bars and the switches connecting them to the transformers and rotary converters in this station are arranged in line in like manner on the two gallery floors. The brick structures enclosing the oil switches and bus-bars of these two distant sets are practically identical in design. Between every oil switch and the bus to which it is connected is a set of three disconnecting knife switches, one in each phase. These are mounted upon the wall, which extends upward from the back wall of the circuit-breaker compartments, and are on the opposite side of the wall from the circuit breakers. The switches are of the hook type and are mounted upon porcelain insulators and are opened and closed by hand by means of a hook on the end of an insulating wooden rod. The blade of the switch is hinged on the dead side of the connection when open.

At Woodhaven Junction substation two of the outgoing branch circuits emerge underground, while the third leaves by the overhead route. The underground feeder cables drop directly from their oil circuit breakers into septums in the basement, where the three cables of one circuit are brought together into a single three-conductor high-tension cable, lead-covered, which carries the current out into the underground portion of the transmission system. At East New York, both the entrance and exit of high-tension cables are underground, and there is no need of a lightning-arrester gallery. The incoming cables enter the basement, run up to the switches and transfer bus-bars and down again to their exit into the conduit system towards Grand avenue. The arrangement of bus-bars, transformers, switches and rotaries is practically identical with that at Woodhaven Junction.

Substation No. 1, at Grand avenue, has but a single set of bus-bars. The feeder cables all enter by underground conduits. The general arrangement is therefore quite simple. The rear end of the basement is utilized for the bus structure, the line of oil circuit-breakers being upon the main floor directly over the bus structure and under the operating gallery, all this gear being at the rear end of the building.

Rockaway Junction has no underground cables, so all circuits enter and leave overhead through a lightning-arrester gallery like that at Woodhaven Junction. As the conditions here are quite similar to those at East New York, the arrangement of transfer and rotary buses, oil switches and apparatus generally is practically identical.

At Hammel there is no transfer bus, and the feeder cables enter the station underground. There being but one set of bus-bars, the high-tension gallery is narrower than in the other substations of standard design. In other respects the relative arrangement of bus-bars, oil switches and cables on the floors of the operating gallery is the same as at the other stations.

The high-tension bus-bars each consist of three sets of bars of rolled copper mounted on porcelain pillars and carried in closed compartments placed one above the other in a structure of yellow pressed brick with alberene stone slabs separating the three tiers. The holes by which the tape enters and leaves the compartments are made through alberene stone slabs bushed with heavy porcelain insulating bushings. Where the bus-bars are sectioned, the compartments in the same tier

are completely divided off by stone slabs. Every precaution was taken to electrically isolate every bar and live connection from every other and from the ground. The potential transformers are in separate closed compartments on top of the bus structure. The type of structure is practically identical for all stations. On the back of each bus structure is built a section of vertical septums or compartments to separate the cables that enter and leave the structure to tap the bus-bars. The septums are continuous with those in the upward extension of the back walls of the oil-switch structures, which are lined up directly underneath the bus structure, excepting at Grand avenue, where their relative positions are reversed.

The switches for manipulating the 12,000-volt-current for the feeders and for the leads to the main transformers are type C Westinghouse oil circuit-breakers.

Both automatic and non-automatic circuit-breakers are employed. They are all automatic except those used for connecting the sections of the transfer bus and for connecting the two transfer buses to the rotary bus. The switches controlling feeders that pass through a station and also those which control apparatus supplied from the rotary bus, are all automatic.

The non-automatic circuit-breakers are electrically controlled from the operating galleries, but are not provided with automatic tripping attachments. The automatic circuit-breakers, although electrically operated by the manual control of switches on the operating stand, are also automatically opened through relays by the current in the circuit in which the circuit-breakers are located.

(To be concluded.)

Vacuum-Tube Regulator.

Two United States patents have been granted recently to Mr. D. McFarlan Moore, on a method and apparatus for regulating the gas pressure in vacuum tubes. As is well known, the pressure of gas in a vacuum tube through which a current of electricity is being passed gradually decreases, thus vitiating the adjustment of the tube and rendering it less efficient for illuminating purposes. On account of this phenomenon the life of such a tube is limited and the efficiency decreases. To overcome this difficulty the present method and the apparatus for applying it have been devised.

The drawing herewith (Fig. 1) illustrates the principle of the method. The horizontal tube is the one through which the current of electricity is passed and which becomes luminous. Attached to this is a tube, at the other end of which there is a gas valve regulated by means of an electromagnet. This magnet is connected in any one of a number of ways in the lamp or tube circuit and is controlled by the current passing through the tube. A decrease in the resistance of the tube, due to a reduction of the vacuum, allows a greater current to pass, which, by means of the solenoid, opens the gas valve and allows air or any other gas provided to enter the tube slowly, and bring back the vapor pressure to the normal point. After this point has been reached the valve will again be closed, due to a return of the current to its normal value, and a further

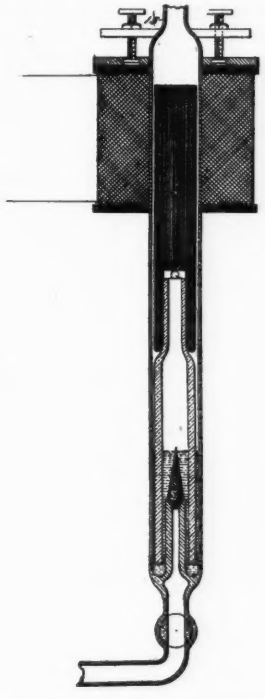


FIG. 1.—VACUUM-TUBE REGULATOR.

entrance of gas will be checked; but when the pressure in the tube has again fallen below the normal, the process is repeated. The adjustment of the pressure in the tube thus becomes automatic and it is said by the inventor that the life of such a tube is indefinite.

The valve may be employed for regulating the supply of any gas to the tube, all that is necessary being that the vapor pressure of the supply be greater than that in the tube.

The other patent covers the regulating mechanism. The drawing in Fig. 2 shows clearly this device. On the vertical end of the supplementary tube, attached to the vacuum tube, is placed the valve. This consists of a tube, preferably of glass, so as to be transparent, within which is a second, and smaller, tube opening into the inlet pipe. The opening of this inner tube is closed by a porous plug of some description, and the space between the two tubes is partially filled with a liquid, such as mercury. A third tube, also of glass, is placed within the outer tube and surrounding the inner. To the upper end of this is attached a core of iron, which is acted upon by the controlling solenoid. When the current is of normal strength, the attraction of the solenoid for this core is not sufficient to lift it up. It therefore will rest on the bottom of the channel containing the liquid, and the latter will be displaced, rising to its greatest height, which will be sufficient to cover completely the porous plug. This liquid forms a gas-tight seal, so that no gas can enter the vacuum tube by this path. Should the current through the solenoid increase, due, for example, to a decrease in the resistance in the vacuum tube, the core will be drawn up slowly, and the sealing liquid will fall and expose more or less of the tip of the porous plug, thus opening a leakage path into the tube, so that any gas present at this point will be able to find its way slowly through the plug into the tube. The greater the value of the current above normal, the larger the surface of the plug exposed and the less the resistance to the passage of gas into the tube. On the other hand, when the current is but slightly above normal, but a small portion of the tip of the porous plug will be exposed; and if adjustments have been made deli-

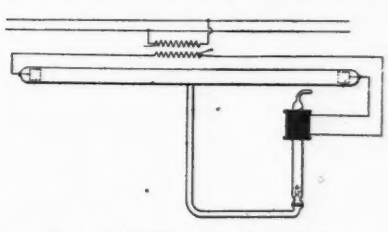


FIG. 2.—VACUUM-TUBE REGULATOR.

cately, the passage of gas into the vacuum tube will be just sufficient to maintain the vapor pressure there constant.

The porous substance may consist of a number of materials, but the ordinary carbon rod used for arc lamps has been found very satisfactory because of its homogeneity and its denseness. Mercury forms a suitable sealing fluid because it does not clog the pores of the plug and is not easily oxidized.

For convenience in shipping, a stop-cock is generally provided below the regulating valve. When this is closed, the valve may be placed in any position without allowing the gas to leak into the tube.

The inventor believes that this method, and the device for putting it into practice, constitute an important development of vacuum-tube lighting, as they do away with a difficulty which has heretofore been most troublesome.

Signaling in the Electric Zone of the New York Central & Hudson River Railroad.

The contract for all block-signaling and interlocking in the electric zone of the New York Central and Hudson River Railroad has been awarded to the General Railway Signal Company, of Buffalo, New York.

Besides being the largest signal contract ever awarded, this work represents an important advance in the art of signaling.

Both block and interlocking work will be all-electric, operated by current taken from a power line running the whole length of the system. All track and signal circuits will be operated by alternating current, the only batteries to be used being storage batteries for the operation of interlockings, which will be charged by an alternating-current-direct-current motor generator drawing current from the power line.

At terminals and on short sections at interlockings, it was practicable to give up one of the rails of each track for signaling purposes, but for the greater part of the system it was of considerable advantage to the electric traction system to allow both rails of each track to be used for the return current.

The system offered by the General Railway Signal Company, and known as the "Young System," was adopted. Alternating current is used for track circuits in connection with reactance bonds, permitting the passage of the direct-propulsion current freely through both of the running rails, while impeding the alternating current used in signaling.

The work included by the contract covers what is known as the "Electric Zone," extending from the Grand Central station to Croton, on the Hudson division, a distance of thirty-five miles, and from Mott Haven to White Plains, on the Harlem division, a distance of nineteen miles. Throughout this distance there will be four main tracks, and the work includes about 3,000 interlocking levers and 1,400 track circuits, aggregating about 250 miles.

The work to be undertaken at the present time covers only that portion of the road to be electrified this year, which carries the work from the Grand Central station to High Bridge on the Hudson division and to Wakefield on the Harlem division.

The two main power stations at Port Morris and Yonkers deliver three-phase alternating currents of twenty-five cycles and 11,000 volts pressure. At the various substations, this current is transformed and converted to direct current at 666 volts for delivery to the third rail for operating purposes.

These substations are also equipped with the transformers for the signal service, delivering alternating current at 3,000 volts to the signal-transmission line, which, although extending the entire length of the district to be signaled, is cut halfway between each pair of substations, thus making that portion of the line fed by each substation entirely independent of the adjoining one.

In order to insure operation should the alternating current fail, direct-current-alternating-current motor generators, taking current from the storage battery system installed in each substation for use of traffic, will continue to feed the signal transmission line with alternating current, and the signal system will continue to work under all conditions under which traffic will be operated.

The 3,000-volt transmission line consists of No. 0 bare copper wire, carried on the pole line and in the conduits used for the main transmission system. Signal bridges are equipped with extension brackets, with cross-arms, for convenience in running wire lines to signals.

For the operation of signal circuits, signal motors, indicators and signal lighting, the 3,000-volt current is stepped down to fifty volts, through transformers placed on signal bridges or transmission line poles. The secondary of the transformer is provided with a ground connection.

For track-circuit operation the voltage depends on the length of track circuits, and varies from one and a half volts for circuits of 200 feet to eight volts for circuits of 5,000 feet.

The reduction from fifty volts to the track voltage is made by a transformer provided with four taps, which will permit of one type of transformer being used on all track circuits.

In laying out the block-signaling plan, the length of the block was determined by the braking distance. For speeds not exceeding forty-five miles an hour the blocks were made 1,200 feet long; for speeds of between forty-five and sixty miles an hour, 2,500 feet, and for speeds over sixty miles an hour, 3,000 feet, the average length of the long blocks being about 3,200 feet. All blocks have a full block overlap. A distant signal is provided for each home signal. On account of the density of traffic and the necessity for quick operation the clearing time of signals is limited to three seconds.

The track circuits are of three types. Where they are 500 feet or less in length, and where the drop in potential in the length of the track circuits is not greater than fifty volts, the "one-rail" system is used, and one rail of the track is given up for signaling purposes, and the arrangement shown in Fig. 1 is used. There being no direct current on the signal rail

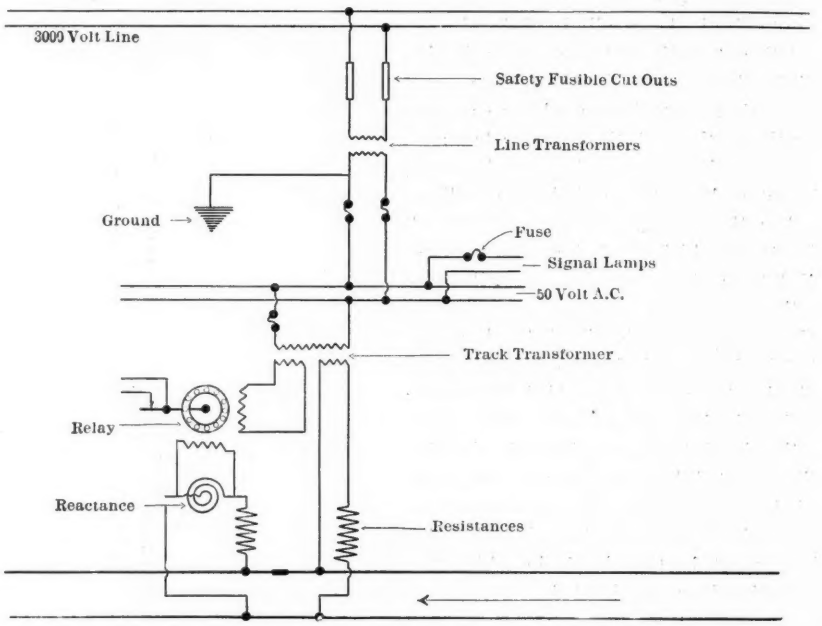


FIG. 1.—SIGNALING EQUIPMENT IN THE ELECTRIC ZONE OF THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD—TYPICAL ALTERNATING-CURRENT TRACK CIRCUIT; ONE RAIL GIVEN UP FOR SIGNALING PURPOSES.

it is not necessary to use any reactance bonds.

On all track circuits over 500 feet in length the "two-rail" system is used, and both track rails are used for the return of the direct-power current, and on all of these circuits it is necessary to use the reactance bonds, by which the connection is made around the insulated rail joints, permitting the direct current used in operating to pass, while impeding the alternating current used for track-circuit work.

around an iron core, as illustrated in Fig. 2; the arrangement of the circuit being as shown in Fig. 3.

For track circuits over 1,600 feet in length a reactance bond formed of a coiled copper bar without any iron core is used.

The use of two styles of bonding was determined by the cross-bonding for the electric traction system. The engineering department of the railroad company determined that the distance between such cross-bonds should not exceed 1,600 feet. For blocks that are 1,600 feet or less in length, the type of bond shown in Fig. 3, allowing cross-bonding at the ends of the track sections, was best suited to the conditions. For track circuits over 1,600 feet in length, where a cross-bond between one rail of each track was required every 1,600 feet, the ironless reactance bond is the least expensive and the one to be used.

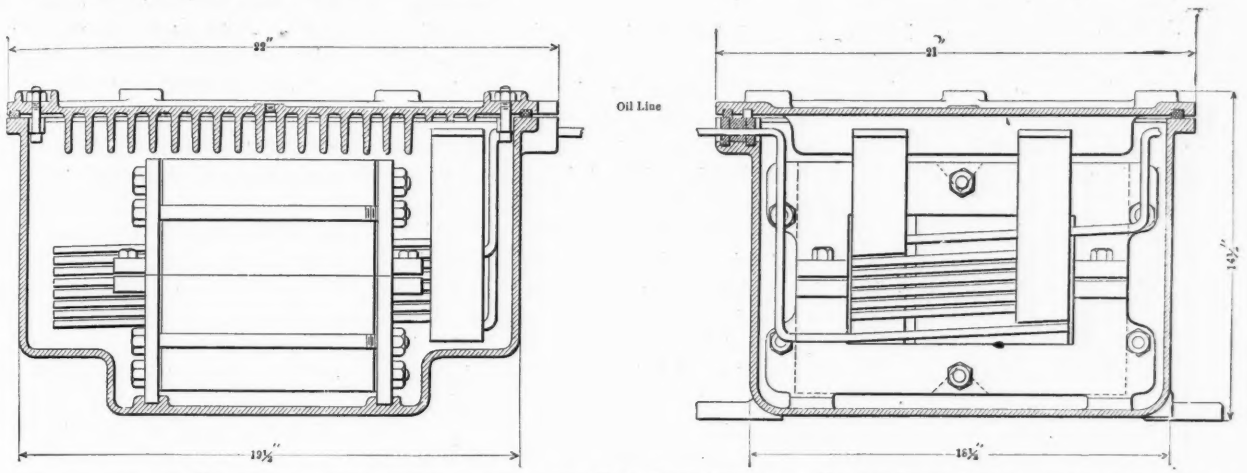


FIG. 2.—SIGNALING EQUIPMENT IN THE ELECTRIC ZONE OF THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD—REACTANCE BOND.

It will be seen that the block sections are of two types, the one-rail and the two-rail systems. In the former the propulsion current flows along the continuous rail, and in the event of a defect in the continuous rail, this current must avail itself of the conductivity of adjacent tracks, through cross-bonding.

In sections of the two-rail system each of the traffic rails of a track forms separate and independent conductors, so that if one rail is interrupted, the other would act as a return conductor, even if there were no cross-bonding to adjacent tracks.

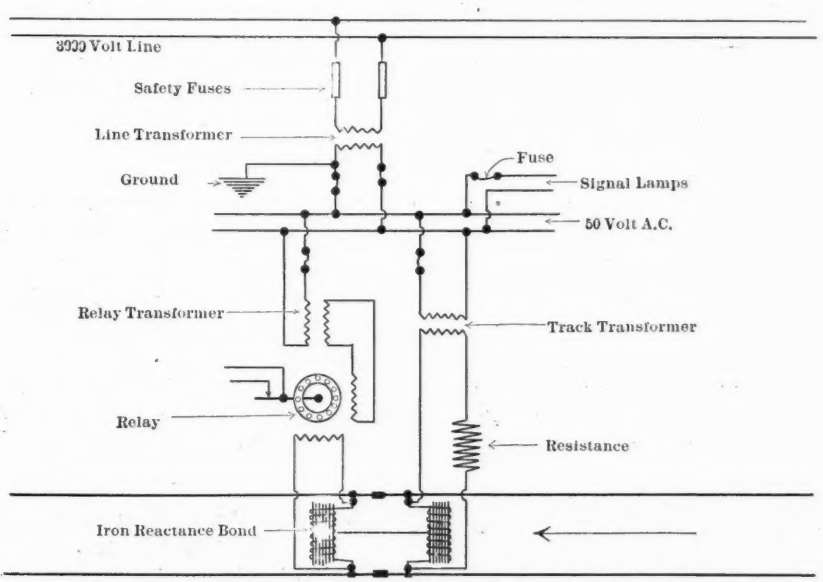


FIG. 3.—SIGNALING EQUIPMENT IN THE ELECTRIC ZONE OF THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD—TYPICAL ALTERNATING-CURRENT TRACK CIRCUIT; TWO-RAIL RETURN, USING IRON REACTANCE BOND.

The insulated rail joints are of the Weber pattern with a steel angle plate on the inside.

On track circuits between 500 and 1,600 feet in length, the "two-rail" system is also used and the reactance bonds consist of a copper bar one inch in cross-section and thirty feet long, coiled in eight turns

All of the reactance bonds are enclosed in water-tight cast-iron boxes, set on foundations, the boxes being filled with oil to carry off the heat generated. The bond is designed to permit the continuous passage of 3,000 amperes for each rail of the track without injurious heating. The casing of the box is made to cover the terminals and connections to the rail to keep them from being tampered with.

The track relay is of the induction-motor type with two field coils. One coil is energized by the fifty-volt signal-operating current. The other coil is energized by the current from the track rails. The armature revolves through an angle of thirty-seven and one-half degrees, during which movement the contacts are separated through twenty-three and one-half degrees, and made up through fourteen degrees, thus giving a good rubbing contact.

Especially hard carbon is used for the fixed point of the contact while the moving point is of platinum. As the controlled current is alternating there is little sparking, although the power corresponds to one-sixth or one-quarter horse-power. The signals are to be of the General Rail-

way Signal Company's motor-operated type, with mechanism placed in the base of the signal mast, and worked by a fifty-volt single-phase alternating motor of one-quarter horse-power.

The lamps are of four candle-power, working on a fifty-volt circuit, and are connected in parallel with a fuse cut-out, to allow any lamp to be disconnected without affecting other lamps supplied on the same circuit. The filament of the lamp is wound in a small circle, to bring the point of maximum illumination within the focus of the lens.

The signals to be used in the Park avenue tunnel will consist of lights only, without any moving parts whatever. Electric lights will be arranged in a box behind lenses of proper color, and the current for the lamps will be directly controlled by the relay contact. Lamps giving the proper color for the stop or caution indication will be lighted when the track relay is deenergized, and those giving the proceed indication will be lighted when the relay contact is closed.

With this installation the colors used by the New York Central for the night-signal indication will be changed in the electric zone, and instead of using white for proceed and green for caution, the system of using green for proceed and yellow for caution will be used for the first time on this line.

The interlockings are of the standard type, manufactured by the General Railway Signal Company, in which direct current furnished from storage batteries is used to operate the switch movements and signals. As usual with this type of apparatus the indication is given by the current formed by the motor, which, on completing its stroke at the signal or switch movement, is changed to a generator and gives sufficient current to release the lock of the lever of the machine. The current to charge the storage batteries is to be obtained from an alternating-current-direct-current motor-generator set, taking current from a transformer fed from the 3,000-volt signal transmission line and furnishing current of 150 volts.

The storage battery consists of fifty-five cells of capacity varying from eighty to 320 ampere-hours, according to the number of daily lever movements to be made. The average time between charging will be four days.

The motor generators with switchboards will be placed in the basement of tower buildings, and a separate battery house will be provided to keep the fumes of the batteries away from the signalmen and the apparatus in the towers.

In this installation the use of detector bars is practically abolished, a few only being used on the outside rail on sharp curves. Short electric-track circuits are provided in their place, effecting the locking of the switches during train movements by controlling the locks on the switch-levers. These short track circuits, with the controlling wires to the interlocking machine, make possible at small expense the use in the interlocking tower of an illuminated track indicator consisting of a track plan of the interlocking painted on a piece of ground glass with the track circuit sections divided on the back of the glass into separate compartments, in which are a red and a white electric light. When the track section is occupied a red light will be shown on the indicator plan, and when unoccupied a white light will be shown.

In places like the Grand Central terminal, where the tracks will be entirely roofed over, it will not be possible for the signal man to observe the movements of many of the trains, and an indicator of this kind is an absolute necessity to enable him to keep in touch with the situation.

As in the Park avenue tunnel, the signals in the Grand Central station interlocking will be shown entirely by lights without any blades or moving parts. In this interlocking work, however, the lever for the signal completes the circuit for the lamps to give the proper color for the indication required.

The signal towers will be of brick, and of very attractive design, with as much window space as possible.

Edison to Use Cobalt for Storage Batteries.

Several interviews with Thomas A. Edison have been published in the daily papers, concerning discoveries of cobalt in North Carolina and other southern states. It is stated that Mr. Edison claims that he will reduce the weight of storage batteries for automobiles one-half, and the cost of traffic in cities more than that. As announced in a recent issue of the ELECTRICAL REVIEW, Mr. Edison has been prospecting for cobalt in the southern states for some time. He has found cobalt in Lincoln, Gaston, Shelby and Jackson counties. Assays of this mineral have been made in many places, and it is announced that the quality found has met with all expectations. Mr. Edison has a force of men in the four counties in North Carolina where cobalt has been found, and a thorough investigation will be made. He is of the opinion that the utilization of cobalt in storage batteries will effect a revolution in the horseless vehicle industry.

Reports on Promotion of Traffic and upon Municipal Ownership to the American Street and Interurban Railway Association.

At the 1905 convention of the American Street and Interurban Railway Association the president was authorized to appoint a committee on the promotion of traffic to investigate the general problem of how to increase the receipts of railway properties, to report at the 1906 convention. An eight-page information blank has been prepared and is being distributed to all the street and interurban railways of America. The information obtained in this manner will be carefully collated by the committee, and, together with other material upon this general subject, will form the basis of the report. The committee stands as follows: W. E. Harrington, chairman; H. F. Grant and H. E. Reynolds.

At the 1905 convention the president was also authorized to appoint a committee on municipal ownership, whose duties would be to make a general investigation of this important problem, and to report at the 1906 convention. A list of questions has been prepared, and this is being distributed to the general managers of street and interurban railway properties in America. The information secured in this way will be used as the basis for a report upon the subject. The committee on municipal ownership is as follows: C. D. Wyman, chairman; J. J. Stanley, H. M. Sloan, John A. Beeler and George F. Chapman.

The office of the American Street and Interurban Railway Association is at 60 Wall street, New York city.

Electrical Night at the Coliseum Garden, Chicago.

On Wednesday evening, June 13, a special concert was tendered by the Electrical Trades Exposition Company, by arrangement with the Coliseum Company and Weil's band, in recognition of the favorable introduction to Chicago, Ill., given this band at the first annual electrical show last January. Wednesday evening was set aside as electrical night, and a liberal amount of space reserved for the electrical people and their friends.

CONVENTION OF THE NATIONAL-INTERSTATE TELEPHONE ASSOCIATION.

AUDITORIUM HOTEL, CHICAGO, ILL., JUNE 25-28.

Arrangements are being completed for the annual convention of the National Interstate Telephone Association, to be held at the Auditorium Hotel, Chicago, Ill., June 25-28. In addition to the business session and the reading and discussion of papers, the manufacturers' committee will have an extensive representation and there will be many entertainment features besides the exhibits of apparatus.

The following programme has been announced:

JUNE 25—10 A. M.

Meeting of committees — "Standard Forms of Accounting." "Standardization of Equipment." "Standard Operating Rules and Regulations."

Meeting of executive council and advisory board.

JUNE 26—2 P. M.

Address of welcome, the Hon. Edward F. Dunne, mayor of Chicago.

Response, E. H. Moulton, Minneapolis, Minn.

President's annual address, James B. Hoge, Cleveland, Ohio.

Officers' reports.

Appointment of committees.

Question Box.

JUNE 27—10 A. M.

Report of entertainment committee. Discussion of and action by the convention.

Roll call of states.

Paper—"Official Organs—National and State," Charles S. Norton, Indianapolis, Ind.

Paper—"Look for the Shield," R. A. Walker, Des Moines, Iowa.

Paper—"Telephone Publicity—Appealing to Public Opinion," Ivy L. Lee, New York city.

JUNE 27—2 P. M.

Report of "Committee on Standard Forms of Accounting."

Paper—"Independent Advertising — Getting Results," W. B. Woodbury, Detroit, Mich.

Report of "Committee on Standardization of Equipment."

Address—"Southern Toll Line and Exchange Development," L. G. Parker, Louisville, Ky.

Paper—"Telephone Revenues," W. P. Hemphill, Topeka, Kans.

Question Box.

Informal banquet at White City, 6.45 P. M.—Colonel J. D. Powers, Louisville, Ky., toastmaster.

JUNE 28—10 A. M.

Report of "Committee on Standard Operating Rules and Regulations."

Paper—"Suggestions—How to Finance Small Telephone Properties," Theodore Gary, Macon, Mo.

Paper—"Texas," J. B. Earle, Waco, Texas.

Reports of outstanding committees.

Presentation of new business.

Question Box.

JUNE 28—1.30 P. M.

Transaction of unfinished business.

Report of nomination committee.

Election of officers.

Installation of officers.

Farewell address, Dwight E. Sapp, Mt. Vernon, Ohio.

BANQUET PROGRAMME.

Toastmaster, Colonel J. D. Powers, Louisville, Ky.

"Change and Exchanges," J. H. Shoemaker, Waterloo, Iowa.

"The Land of the Jack Oak and the Paw Paw," Jesse W. Weik, Greencastle, Ind.

"The Great Northwest," Charles E. Sumner, Portland, Ore.

"Our Rural Telephone Business: What Shall the Standard Be?" Nelman F. Wing, Grass Lake, Mich.

"Why Are We Here?" J. Walter Barnes, Fairmont, W. Va.

"Buckeye Briefs—and Other Things," the Hon. H. M. Dougherty, Columbus, Ohio.

"What We Have Done to the Rocky Mountain Bell in the Rocky Mountain Country," Elmer B. Jones, Salt Lake City, Utah.

New Departure in Cuban Railway Work.

The city of Havana, Cuba, is well equipped with electric railways. Within the city limits the street car lines are operated by the Havana Electric Railway Company, while the interurban service between Havana and the surrounding towns is handled by the Havana Central Railway Company. These companies are developing rapidly, the equipment for both the present and additional rolling stock and track material being of American manufacture. The Havana Electric Railway, the city line, has recently ordered 100 G. E.-52 railway motors for additional cars.

The Havana Central company operates an electric railway system between the Cuban capital and several surrounding towns. The entire equipment is of the most modern type, including Curtis steam turbines for power generation. Both electric locomotives and motor cars are employed in the service, ten forty-ton General Electric locomotives being used for freight and about twenty-five motor cars for passenger traffic. The cars are equipped with G. E.-73 railway unit control, so that they can be operated singly or in trains.

The lines of the Havana Central company radiate from Havana to various towns, and the transmission system from the central power station at Havana electrically connects the capital with many places where there are at present no lighting stations. The railway company is therefore preparing to supply a lighting service to the cities of Guines, Guanajay, San Jose and Regla, making use of the present railway transmission system and constructing substations at the towns mentioned, in order to change the twenty-five-cycle current to one of higher frequency for lighting purposes.

For this purpose, the five substations are each to be provided with an induction motor, alternating-current generator set which will transform the present twenty-five-cycle alternating current into one having a frequency of sixty cycles. Each set comprises a 150-horse-power, 750-revolutions-per-minute, 370-volt induction motor, taking current from the step-down line transformers, and direct-connected to a three-phase, 100-kilowatt, 750-revolutions-per-minute, 2,300-volt alternator, delivering current at approximately sixty cycles. For stepping down the railway transmission line current, a single 150-kilowatt, three-phase transformer is to be installed at each substation. The windings on the transformers are provided with taps to take care of variations in line voltages and are so arranged that the transformers can be operated on either 19,000 or 33,000 volts, and the secondaries connected to give 370 volts or 185 volts on either of the primary connections. Including the necessary switchboards, instruments, wire and cable, the complete substation apparatus will be furnished by the General Electric Company.

Besides the fixed substations at the points mentioned two complete portable substations of like capacity and equipment will be constructed. These will be mounted on regular freight trucks so that they can be easily transported by rail to points where there is a special local demand for electric lighting. The whole arrangement presents an interesting development in railway lighting, particularly since it is taking place in a country which has adopted electricity within a very few years.

Reviews of Current Engineering and Scientific Literature.

An Improved Method of Reading Electrometer Deflections.

The leaf electrometer is a simple and sensitive instrument for indicating slight differences of potential, but, on account of its construction, it is difficult to read it accurately. The leaves do not present a sharp, straight edge which can be thrown against a screen for this purpose. To improve the instrument, Herr K. Kurz has devised a means for overcoming this difficulty. One leaf of the electrometer is made of aluminum and this has a shallow groove cut across it at the lower end. Across this groove is stretched a quartz fibre, which is cemented to the leaf. The deflections of the leaf are then observed by means of a telescope, the fibre appearing as a sloping black line on the scale of the instrument, making accurate readings easy and forming a decided improvement over the old type of instrument.—*Translated and abstracted from Physikalische Zeitschrift (Leipsic), June* 1.

Concerning the Temperature of the Nernst Lamp.

The early determinations of temperature of the incandescent glower of the Nernst lamp give values believed by L. W. Hartman to be much too high. These determinations have been based upon the law of the radiation from a black body, a class of radiators to which the Nernst glower does not belong. For these reasons a research which does not involve this error of assumption should be interesting and valuable. He describes briefly some of the earlier attempts to determine the temperature of the glower, pyrometric means being employed. The values obtained in this way were fairly concordant, and indicated a temperature of 2,360 degrees absolute. The method employed by the author makes use of the thermo-couple. Several couples were constructed of platinum and platinum-rhodium, the wires being of different sizes. A Nernst glower, connected in series with a suitable ballast and regulating rheostat, was then brought up to normal incandescence and the junction of a thermo-couple moved slowly up to it. When first conducting this experiment, the author was much surprised to find that the junction of the thermo-couple could be brought in contact with the glower without its being melted or in any way affected. This was true of the smallest junction, which had a radius of only 0.036 millimetre. This was the first indication that the temperature of the filament was much lower than that previously given. By means of thermo-couples of different sizes, values were obtained which enabled a curve to be plotted between the electromotive force and the cross-sections of the wires of the couple. This curve was then extended back until it intersected the axis of diameters, the value thus obtained being assumed to correspond to that which would be obtained with a thermo-couple having no size. Readings were taken in this way on a number of different glowers. The values obtained varied from 1,780 to 1,800 degrees absolute. The mean value is 1,791 degrees absolute. After obtaining these readings the thermo-couples were checked again by means of a Bunsen flame. It was found that they had not been changed. The author then compares the performance of these glowers with that of black bodies of similar dimensions, and shows that the number of watts required per unit length of glower to raise them to a given temperature is much more than that taken by the Nernst glower; hence the latter can not follow the law of black body radiation. If it is assumed that the temperature of the glower is that which a black body would have, the watts lost per centimetre length would be small, ranging from five to seven per cent. On the other hand, taking the temperatures obtained by the thermo element as correct, the loss is 70.5 per cent. From these considerations it is concluded that the economic superiority of the glower over that of a black body is not so great as has been claimed.—*Abstracted from the Physical Review (Lancaster), June.*

A Study of Electricity and Gas at Newcastle.

An interesting comparison is made here of the development of the gas and electric industries at Newcastle, England. There are in this locality two electrical supply companies, which some years ago came to an understanding regarding the territory which each should serve. One of these, the Newcastle-on-Tyne Company, has reached out and now covers an area of 400 square miles, while the other has limited its attentions more strictly to the city. The latter company has not grown as rapidly as the former, so that the comparison which is made between the average of the two and the gas system is more favorable to the gas company than it would have been if the figures for the larger and better-equipped electric company alone had been taken. The data show that the price for electrical energy has decreased continuously from 1891, slowly up to 1900, and then rapidly. In 1891 the average price was 9.5 cents per kilowatt-hour. In 1900 it had fallen to 7.6 cents, and in 1904, the last year for which figures are obtainable, it was 2.86 cents. In 1893 the electric companies sold a little less than 750,000 kilowatt-hours. In 1901, after the price had been reduced considerably, the sales jumped to 4,180,000 kilowatt-hours. From that time they have increased very rapidly, until in 1904 they were over 20,000,000 kilowatt-hours. In spite of the great reduction in price, the profits in 1903 were practically the same as in 1892; while, on account of the larger business done, the industry was on a much more substantial basis. During this time the competition with the gas company has been sharp. The price for gas has varied considerably, and is at the present time greater than it was at the beginning of this period of comparison. The amount sold has increased, but at a lower rate than the electrical supply. The investment has also increased at about the same rate as the sales, whereas with the electrical supply companies the increase in investment has been at a slightly less rate. The profits from the sale of gas have varied in different years, but have not changed materially, and are now about the same as they were in 1894. An interesting feature in the sale of gas was that during the years 1901, 1902 and 1903 there was practically no increase in the output, due probably to an increase in the price which was made to offset an increase in the cost of coal. It is thought that the figures show a rather one-sided state of affairs, for the electricity companies appear to have it all their own way; and although the output of gas has increased during the period of competition, its rate of increase has fallen off and the gas consumers have not benefited at all. On the other hand, the price for electricity has been steadily reduced, thus improving the load factor and increasing the output, without reducing the profits, thus putting the company in a much improved financial position.—*Abstracted from the Electrical Engineer (London), June* 1.

British Board of Trade's Electrical Standards Laboratory.

A description is given here of the electrical standards laboratory of the British Board of Trade, London. At this laboratory no researches are carried out, as it is intended merely as a depository for the official government standards and as a place where comparisons may be made. While a good deal of time is spent in devising and trying methods of measurement, when necessity arises, it is not the business of the laboratory to carry out any scientific investigations or researches. At this laboratory are kept the official standards which were verified in 1894, but, should any redetermination be necessary, it will be carried on elsewhere. The work of the laboratory is divided into two branches, one for verification and the other for proof. The first of these consists in the comparison of instruments with the standards or substandards. The second consists in the examination and testing of meters and other apparatus, the pattern and construction of which the Board of Trade is authorized to approve. The instrument for determining the standard current is a dynamometer, the fixed coils of which are wound in grooves in a marble cylinder. A third coil is suspended from a balance. Means are provided for adequately adjusting the axes of the fixed and movable coils. The current is led into the suspended coils by fine silver wires, and although these reduce the sensibility of the apparatus considerably, they still leave it able to be read much more closely than the electrochemical equivalent of silver is known. In order to keep the coil dry a current of three-quarters of an ampere is kept passing through it continually night and day, but even this is not enough to keep it thoroughly dry. The zero of the coil changes from day to day with variable weather. The secondary standards consist of a series of Kelvin balances, which enable any current from one to 2,500 amperes to be measured. The conductors in this laboratory are of the concentric type, so as to avoid any stray magnetic fields. Current is provided by a storage battery which can give 6,000 amperes for half an hour and 10,000 amperes for a few minutes. For measuring these heavy currents manganin shunts are provided. The volt standard is a Kelvin multicellular electrostatic voltmeter. The Clark cell is taken as a definition, and not as a standard. For measuring higher voltages there is a set of six multicellular voltmeters which can be used up to pressures of 3,200. For controlling the heavy currents, two mercury rheostats are placed outside of the laboratory, the principal one carrying 1,000 amperes, the lower one heavier currents. These rheostats consist of troughs of enameled iron containing mercury. There is a strip of copper held in the bottom of the trough to increase the conductivity. A short-circuiting bridge is provided, which can be moved along the troughs, thus increasing or decreasing the resistance. There is a constant-temperature room, maintained at a temperature slightly above that of the outside air. The temperature is regulated by a thermostat and a gas stove. This room is used for accurate comparisons of resistance coils. The standard coil was placed here in 1894, and has not been removed since. It has never been subjected to a temperature lower than twelve degrees centigrade nor one higher than twenty-five. It has never carried a current greater than one-twentieth of an ampere, and therefore it is likely that its resistance has not altered. Two specimens of double-coil ohm substandards have been made with wires of metals having temperature coefficients differing in the ratio of about one to twelve. By subjecting these to tests of their resistance throughout a small range of temperature, the temperature can be computed at which the two resistances become equal, and also the resistance at that temperature. These coils can be sent for comparison with the standards of another laboratory without any comparison of thermometers being necessary. Each thus constitutes not only a resistance substandard, but a one-point thermometric standard. The laboratory contains a collection of commercial meters of approved form.—*Abstracted from Engineering (London), May 25.*

European Telephone Figures.

Some figures were given recently by W. E. L. Gaine, the general manager of the National Telephone Company, of London, showing the development which had taken place in the telephone industry in Great Britain, and comparing this with the growth in other countries. The increase in the number of telephones during the last twelve months has been at the rate of fifteen per cent. The total number is now 378,000. The messages transmitted are 1,052,000,000 yearly.

It has been said that Great Britain is behind all other countries in telephone development. To prove that this is not so, a comparison is made with other European countries. It is shown that Austria-Hungary, Belgium, Holland, Italy, Norway, Portugal, Russia, Spain and Switzerland, with a total population of 288,000,000, have only 30,000 more telephone stations than the United Kingdom, with only 42,000,000 inhabitants. Eight countries—France, Austria-Hungary, Belgium, Holland, Denmark, Norway, Portugal and Switzerland—have together 7,331 stations less than the United Kingdom. The Scandinavian countries—Sweden, Norway and Denmark—and Belgium, Holland and Switzerland have 105,000 stations less than Great Britain. The only country in Europe upon the same platform with Great Britain is Germany, which has a population of 58,000,000 and 10.2 telephone stations for each 1,000 inhabitants. For Great Britain and Ireland the figure is 10.15.

Leaving out France, Germany and Sweden, no European country has as many telephones as London alone. London, with a population of 6,000,000, has nearly as many telephones as the whole of France, with a population of 39,000,000; the whole of Sweden, Austria and Belgium, with 60,000,000; or Switzerland, Norway and Denmark, with 10,000,000. On the other hand, the telephone business has not developed as it should have if it had been given a fair chance.

Reference is made to the conditions in America, where "the service is not cheap and nasty, but scientific and highly developed, adequately paid for and worth paying for."

The legal decision made some time ago that the telephone is a telegraph, thus putting it under the heel of the government, has greatly retarded its development. Now since the government has at last adopted a settled policy regarding the telephone, it is expected that the development will be much more rapid.

Attention is called to the use of private exchanges in large offices. The adoption of this system in Great Britain is not expected until a more reasonable method of charging has been put in force. As long as unlimited service is given for a fixed price this development can not be hoped for. "The rates in America are based, as they should be, on the amount of service, and similar principles must be adopted in Great Britain."

Application for a charter has been made to the Pennsylvania State authorities by the Westinghouse Consolidated Foundries Company, of Pittsburg, Pa. The object is for the various Westinghouse Companies, which now have foundries at Pittsburg, Allegheny City, Cleveland and Attica, N. Y., to have all their castings made in one factory, which is located at Trafford City, near Pittsburg. This plan is to assure greater economy and uniformity in the making of foundry products.

Methods of Getting New Business.

A department devoted to the commercial development of Central Stations. Managers are invited to contribute suggestions for methods of increasing the demand for electric service.

In a talk before the Iowa State Electrical Association on the subject of "Modern Methods of Advertising," Frank B. Rae, Jr., secretary of the C. W. Lee Company, Newark, N. J., made some very interesting points concerning this subject.

"Advertising, when stripped of its trappings and gilt, is a very plain, commonsense business proposition—a proposition of selling goods. While it would seem that this is simple enough and obvious as the first proposition in geometry, it is a fact that only a very small percentage of so-called advertising conforms to this definition. On the contrary, the fundamental principle has been so hidden by a maze of high-sounding words that not one man in a thousand of those who foot the bills knows what he is trying to accomplish or is paying others to accomplish for him. He staggers along blindly, believing that any sort of an announcement regarding his business is advertising; and the more startling the form and wording of this announcement, the better advertising he believes it to be.

"Advertising has been likened to salesmanship. 'Salesmanship on paper' is the expression of a clever advertising man. For practical purposes this is a very good definition.

"There is just one mystery in advertising—the mystery of the personal equation. Advertising—real advertising—is good or bad, only as the man who prepares it is gifted or not gifted. Words are in every man's mouth, but every man can not be a Patrick Henry. A pen is in every man's hand, yet every man is not a Shakespeare. The tools of advertising are within every man's grasp, yet very few men can write an effective advertisement. It is well for us to recognize at once that the gift to see and express in advertisements, the possibilities of a business, is no more common than the gift to see and express in poetry the inspiring beauties of nature.

"You have all listened to the clever salesman. He came unknown, unasked, and unannounced. His dress and appearance were his credentials; a bright word, his introduction. In terse, clean-cut English, he told his story; with convincing logic he drove home his argument; with undeniable assurance he solicited your business. Tact, courtesy, good-breeding stamped each word. If he did not get an order, he left an indelible impression of the worth of his goods. Perhaps you did not want to buy them—for any one of a thousand reasons—but sooner or later his well-delivered arguments, his tactful insistence, will win you. You will buy.

"What were this salesman's qualifications? He was tastefully, or at least, decently, dressed; his introduction commanded your attention; his argument appealed to your reason; his tact and cleverness assured him a future opening if not an immediate sale. These are the qualifications of a successful salesman. They are the qualifications of the successful advertisement.

"It must be understood that the backbone of your business-getting department is the solicitor. Advertising can persuade a man of the advantages of your service, can convince him that he needs it, can crystallize his desire into an immediate demand for specific information touching his individual wants, but it can not figure his installation or secure his signature to a contract. This requires a solicitor.

"Granted that you have intelligent and energetic solicitors, the advertising will be designed to bring the prospects to the point where it will require the least amount of the solicitor's time to close a contract. To do this is not the work of a single advertisement, nor of a number of diversified and disjointed advertisements. It is the work of a long-continued, regular, systematic advertising campaign.

"It is here that the average lighting manager interposes objections. He is perfectly willing to take a flyer—to send out three or four mailing cards, perhaps, or insert a so-called catchy advertisement in the newspapers. Such advertising, if advertising it can be called, is the sheerest waste of money. Object as you will to this statement, if you will but compare again your advertising campaign to the work of the accomplished salesman you will begin to see the reason 'why of' the follow-up method. For your salesman does not always get an order on his first call or his second or his third. It may take a half dozen calls to educate you to the advantages of his goods and to win your confidence—in short, to bring you to the buying point. Had the firm employing this salesman sent a different man each time; had the various men employed radically different methods, it is probable that you would pay little if any attention to their solicitations; but the one man, the one method, the constant, aggressive, persistent follow-up—that is what lands the order.

"And that is what will land orders from advertising.

"The matter of such a follow-up campaign should be planned and systematized in advance with very strict regard to local conditions. It is in the planning and systematizing that such a campaign wins or loses—in the logical sequence of the advertising used. The system of handling inquiries, of checking and revising the mailing lists, of adapting the solicitors' labor and reports to the mutual benefit of both solicitors and the advertising—these are all vitally important points to be settled before a single piece of matter is used. Having settled them the actual follow-up work resolves itself into the very simple proposition of seeing that the matter goes out promptly on the scheduled dates, that inquiries are carefully followed, and that the enthusiasm of the soliciting force is kept at fever heat.

"When it is understood that the chief object of the advertising is to pave the way, introduce and make definite appointments for the solicitors, the importance of having the latter always aggressive will be appreciated. The actual business-getting must, and always will, remain with the soliciting force.

"'Modern methods of advertising,' so far as the central station is concerned, means merely that you regularly and persistently keep the advantages of your service before every prospective customer within reach of your mains. That such methods can be adopted with profitable results by the smaller plants has been demonstrated.

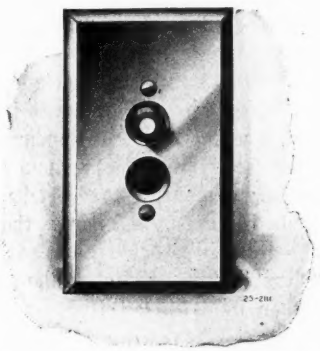
"But a warning should be sounded. Do not make your advertising too elaborate, or too voluminous. Do not waste it upon ill-chosen lists. Most important of all, do not allow it to be designed by an advertising man ignorant of the ethics of the lighting business, or by a lighting man lacking in advertising genius and experience."

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

The "G. I." Flush Push-Button Switch.

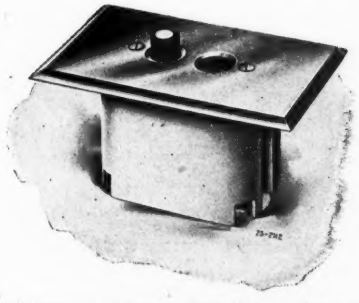
The accompanying illustrations show the new "G. I." flush push-button switch placed upon the market by the Stanley-G. I. Electric Manufacturing Company,



"G. I." FLUSH PUSH-BUTTON SWITCH.

Pittsfield, Mass. This switch is designed to meet all the demands of modern conditions. The porcelain shell is small, and the mechanism is compact, allowing ample spacing between live parts of opposite polarity. It is easy to wire, because of the protected corners of the porcelain, and the convenient location of the terminal screws.

The moving parts, with the exception of the contacts, are made of hardened steel. The contact blades are of brass, thoroughly insulated from the rest of the

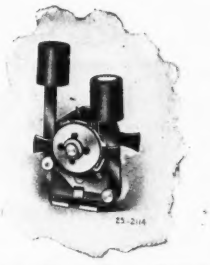


PUSH-BUTTON SWITCH, SIDE VIEW, SHOWING PORCELAIN SHELL.

movement by sheet mica. The contact clips are made of phosphor bronze.

The movement is of the rotary type, combining a short push with positive action. It is made single-pole, double-pole, three-way and four-way, with standard size single plate. The switch may also be furnished with gang plates up to eight. The overall dimensions of the porcelain are: Length, two and three-quarter inches; width, one and three-quarter inches; depth, two and one-quarter inches.

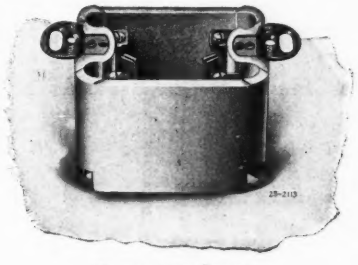
The switch is designed with an unusually long breaking distance, so that it



MOVING PARTS OF FLUSH PUSH-BUTTON SWITCH.

may be used with safety on 250-volt circuits.

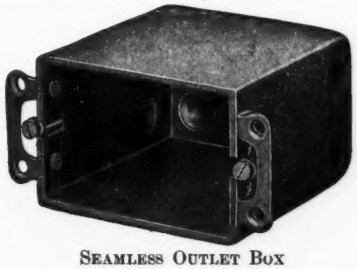
While the "G. I." flush push-button switch is adapted for use with all standard outlet boxes, the company has designed the "G. I." seamless outlet box, made of drawn steel, combining the elements of neatness



PORCELAIN SHELL.

and strength, and made entirely without seams. It is provided with smoothly-finished knock-out plugs in both the bottom and ends. The supporting ears are firmly riveted to the box.

The inside dimensions are: Length, two and seven-eighths inches; width, one and seven-eighths inches; depth, three and one-eighth inches. The box is suitable



SEAMLESS OUTLET BOX

for use with all flush push-button switches and wall receptacles that do not exceed these dimensions. In order to prevent rust, the box is thoroughly japanned inside and out.

New Electrical Equipment of the Dan River Power and Manufacturing Company, Danville, Va.

In the cotton industry the rapidly increasing demand for electrical equipments is especially noticeable, an illustration being the recent order from the Dan River Power and Manufacturing Company, Danville, Va., for its new plant, placed with the Baltimore office of the Westinghouse Electric and Manufacturing Company.

The contract is practically a duplicate of the present installation, which has been in operation about eighteen months. The new plant when completed will be one of the best electrical installations for cotton mill work in the country. The mills are designed by the well-known firm of Lockwood, Green & Company, of Boston, and have the latest type cotton-mill machinery driven by Westinghouse induction motors.

The power plant is on the Dan river about a mile distant from the mills and will contain when completed three 750-kilowatt and three 500-kilowatt alternating-current revolving-field generators of the water-wheel type, with two 125-kilowatt direct-current exciters and complete switchboard equipment.

The recent order for new apparatus includes one 750-kilowatt, revolving-field, 6,600-volt, twenty-five-cycle, three-phase water-wheel generator; two 500-kilowatt generators with the same characteristics; switchboard equipment; bank of three 400-kilowatt, oil-insulated, water-cooled transformers complete with oil-controlling switch; low-tension switchboard and twenty-four 440-volt, three-phase induction motors, which will be used for operating the different machinery in the cotton mills. The sizes of the motors are as follows: Fourteen 100-horse-power, five 150-horse-power, two fifty-horse-power, two forty-horse-power and one seventy-five horse-power.

National Carbon Company Purchases United States Carbon Company.

The National Carbon Company has purchased the United States Carbon Company, of Cleveland. The latter is the concern which was taken out of the hands of a receiver some months ago by M. B. Brady, of that city. He is said to have paid $90,000 for the property and reorganized it with $500,000 capital.

A New Insulator Pin.

In the description of the transmission line and third-rail system of the Long Island Railroad published in our issue of June 9, attention was called to the new type of iron insulator pin employed. This pin, which is a radical departure from previous practice in pin design, is the invention of W. N. Smith, of Westinghouse, Church, Kerr & Company, who has applied for a patent on the device. The design has been further improved and arrangements are now being made for manufacturing and placing it on the market, under the name of the "Smith-Grip" insulator pin.

This pin does away with the necessity of boring holes in the cross-arms, thereby conserving the whole strength of the arm and lengthening its life; the metal composing it is distributed in the most effective manner, as its cross-section is greatest next to the arm where the greatest resistance to bending is required; and the shrinkage of the arm can be effectively taken care of by the U-bolt and strap, as there is no tendency to distort the bolt, and consequently there is no possibility of the pin standing crooked upon the arm after the shrinkage has been taken up. It is claimed to be practically indestructible, and is expected to be the strongest factor in line construction.

THE "SMITH-GRIP" INSULATOR PIN.

More than 8,000 of the pins as originally designed and shown in the accompanying illustration were used in the transmission line construction of the Long Island Railroad, carrying 250,000-circular-mil cables in spans averaging 150 feet in length, and no failures have yet been reported after over a year of service. A dozen or more standard sizes of the improved design are being worked up to fit several sizes of cross-arms and pole tops, and to carry insulators of varying sizes up to the highest voltages in practical use. The pins will be made of either cast or malleable iron to suit the purchaser's conditions.

While it is designed particularly for use with wooden cross-arms, it can readily be adapted to steel cross-arms, and to such special fixtures as are often necessary in heavy transmission-line construction. On account of its mechanical design, it will also find a place in heavy catenary trolley construction, which is now being actively developed for the electrification of railways by the single-phase system.

A Special Pocket Blow-Torch.

M. W. Dunton & Company, Providence, R. I., manufacturers of "Nokorode" soldering paste, in order to attract the attention of electrical workmen to their products, have offered a pocket torch for the return of fifty tin covers from their two-ounce decorated cans. These alcohol pocket blow-torches are five and three-quarter inches high by seven-eighths of an inch in diameter. The size of the flame is adjustable, the torch thoroughly nickel-plated on brass, and the apparatus is really a very neat and attractive device. This offer is open until July 1, 1907.

POCKET ALCOHOL BLOW-TORCH.

The accompanying illustration gives a good idea of the blow-torch.

American Apparatus for Largest Japanese Power Station.

The Tokio Electric Light Company, which has under construction the largest water-power station in Japan, in carrying out its extensive plans, has placed large orders with an American manufacturer for miscellaneous electrical apparatus. The main power station of this company is located about twenty-five miles from Tokio on the Tamagawa river, and high-voltage electrical transmission lines bring the power there generated to a substation just on the outskirts of the Japanese capital. With the exception of the water-wheels and generators, which are of German manufacture, all the main station apparatus was ordered some time ago from the General Electric Company, of New York. At the substation the voltage is reduced by transformers and distributed underground to various smaller stations within the city. The Tokio Electric Light Company has just ordered all the additional apparatus for this purpose from the same American concern. This order will include the shipment of fifty-five 250-kilowatt transformers and seventy-eight single-phase potential regulators, as well as switchboards and auxiliary apparatus. As electricity is used for both lighting and power, the potential regulators provide a means for keeping the voltage constant at the lamps so that their light will be steady and uniform.

Automatic Telephones for Skibo Castle.

Andrew Carnegie has purchased from the Automatic Electric Company, Chicago, Ill., a complete private automatic telephone exchange of twenty lines for his Scottish estate, Skibo Castle, Bonar Bridge, Sutherland, Scotland.

Mr. Carnegie's sister-in-law, Mrs. Lucy Carnegie, has an automatic exchange of twenty-two lines on her estate, Dungeness, on Cumberland Island, just off the coast of Georgie. The Dungeness exchange has been in operation over two years, and Mr. Carnegie was so pleased with its working that he decided to use the same system at Skibo Castle.

K. B. Weatherbee, Mr. Carnegie's mechanical engineer, was in Chicago during the latter part of May to familiarize himself with the automatic system, and expects to install the exchange at Skibo Castle in August.

The initial installation will be for thirteen telephones, five of which will be in the castle, one in the estate office, two in the stable and garage, one in the gamekeeper's lodge, one in the gardener's lodge, one in the golf house, one at the dock on Dornoch Firth, where Mr. Carnegie's yacht is kept, and one at the natatorium. The estate is about ten miles square and the automatic telephones will probably be scattered all over it eventually. The automatic system will replace an old magneto manual system that has been in use there for some time.

The Beck Flaming Arc Lamp.

The Beck flaming arc lamp is one of the latest developments in arc lamp construction, and aside from its value as to light economy, it possesses additional advantages of merit. The accompanying illustrations show the extremely simple principle of construction, which is entirely new.

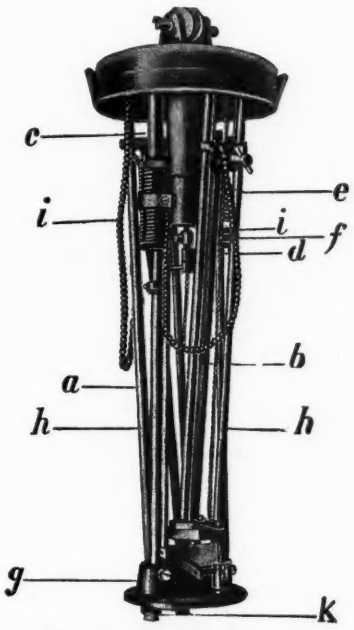


FIG. 1.—MECHANISM OF LAMP.

One of the troubles met with in flaming arc lamps has been due to the fact that the vapors from the carbon would get into the mechanism; and where this mechanism is complicated, considerable trouble results.

FIG. 2.—FEEDING MECHANISM.

Mr. Heinrich Beck, of Meiningen, Germany, has worked out this new principle of carbon feed, the simplicity of which is very striking. The principle of the feed is that the carbon, which has a rib running its entire length, rests on a metallic shoe. This rib burns to a fine point. The point gradually disintegrates and crumbles, and allows the positive carbon to sink slowly by gravity; and as the negative carbon is connected by a compensating chain, it feeds downward at the same time.

The positive carbon is of greater diameter than the negative carbon, so as to allow the electrodes to burn evenly.

Fig. 1 shows the mechanism of the lamp, and Fig. 2 the feeding mechanism. The carbon on the left burns to a fine point, which rests upon a metallic stud.

Fig. 1 shows the mechanism of the lamp with the case removed. The carbon, *a*, is rigid, and the carbon, *b*, is loosely supported. The current passing through the magnet, *c*, swings the carbon, *b*, to the right, and at the same time the arc is formed. The length of the arc can be regulated by the check nut, *d*. The magnet, *c*, in direct-current lamps is entirely encased in iron so that damage is impossible. Under the magnet is a dashpot, *e*, which prevents the too rapid pulling apart of the carbons. The dashpot is easily removed by screwing to the left and is made out of a tube, using a graphite plunger; while burning an asbestos ring, *f*, keeps the dashpot tight to prevent fumes or ashes from getting in. In alternating-current lamps the iron housing of the magnet is dispensed with, but the magnet is thoroughly protected. In both direct and alternating-current lamps the magnet is wound with heavy wire, and is in series with the carbons.

The reflector is made of enameled iron, and is supported by two iron rods, *hh*. On these rods are two blowout magnets, *ii*, which are wound with bare wire and have a movable contact. Through these movable contacts it is possible to so adjust the blowout magnets that the flame will be projected downward, so as to give the greatest efficiency. The alternating-current lamps have no blowout magnets, but are otherwise practically the same as the direct current. The lamp is provided with a cutout, so as to cut out the lamps when the carbons are burned to their lowest points.

The regulation of the lamp is effected by the adjusting screw, *d*, which allows the space between the carbons to be increased or decreased. The lamp uses forty-two to forty-five volts at the arc to burn at its best.

The lamp is made to burn singly on fifty-five to sixty-five volts, two in series on 110 to 120 volts, and four in series at 120 to 240 volts. The lamp burns from eight to fifteen hours, depending on the length of the carbons, and consumes 0.163 watt per hemispherical candle-power.

The light is of a golden-yellow color, and the ray is particularly penetrating. A white or deep-red light is also possible by changing the composition of the carbons.

The Beck flaming lamp is being marketed by the Beck Flaming Lamp Company, 58 West Fifteenth street, New York city, of which Louis J. Auerbacher is president.

The Report of the Lincoln Telephone Company.

The Lincoln Telephone Company, Lincoln, Neb., has compiled an interesting report of its annual earnings and expenses for the year ending December 31, 1905. The number of telephones in operation was 3,583. The gross annual income was $77,060.44. The operating expenses, maintenance, taxes, etc., were $38,053.05. The interest on bonds amounted to $24,414.67, leaving a surplus applicable to dividends of $14,581.72.

Basing future growth of the plant on business secured during 1905 and a conservative estimate of the business for 1906, the company should have 5,000 telephones in service May 1, 1907.

The company is operating under a fifty-year franchise given by the city council of Lincoln. It owns its exchange building, which is forty-five by eighty feet, two stories and basement. The equipment for the entire exchange was furnished by the Automatic Electric Company, Chicago, Ill., and embodies its latest apparatus throughout.

F. E. Ebersole, general manager of the company, states that experience with the automatic system has proved that the larger the number of telephones in use, the less the cost per station to operate. In fact, the operating cost has been reduced in this exchange a considerable amount per telephone within the past year The cost of operation per telephone per year, based upon January, 1905, was about $1.12 greater than the cost of operation per telephone based on the month of December, 1905.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

ERIE ELECTRIFICATION CONTRACT AWARDED—The Erie Railroad has awarded a contract to Westinghouse, Church, Kerr & Company for the electrification of that portion of the Rochester division between Mount Morris and Rochester, N. Y., a distance of thirty-five miles. If this installation should prove efficient the division to Corning will be electrified, with branches to Hammondsport and Conesus lake.

MILWAUKEE CITY ATTORNEY HOLDS LIGHT BOARD ILLEGAL—City Attorney Kelly, Milwaukee, Wis., has rendered an opinion in which he holds that the lighting commission has none of the powers which it believed were vested in it, and that the common council, in fact, holds the power of installing a lighting plant. The attorney holds that the commission has no power to advertise for sites, nor to incur any expense in that behalf or for any other purpose.

COLUMBUS, OHIO, LOSES LIGHT FIGHT—Columbus, Ohio, has lost its fight for cheaper electric lights. The ordinance passed by the city council July 5, 1904, fixing the maximum rate for light at five cents per kilowatt-hour, is held to be unconstitutional by Master Commissioner T. P. Linn in his report to Judge Thompson, in the United States Court, in the suit brought by the Columbus Railway and Light Company against the city, to enjoin the enforcement of the rate. The company may now continue to charge the present maximum rate of twelve and one-half cents.

NEW RHODE ISLAND ELECTRIC LINE—The building of an electric railway from Providence, R. I., to Worcester, Mass., is said to be assured by the negotiations recently consummated, whereby the newly incorporated Worcester & Providence Street Railway Company will obtain the right to enter Providence over the lines of the Rhode Island company. The new company, capitalized at $2,000,000, purposes building a direct line from Providence to Worcester overland for the rapid transit of both freight and passengers between the two points, without regard to intervening towns or villages.

POWER PLANT ON THE ROANOKE RIVER—A power plant is projected at Eagle's Ferry, about twelve and one-half miles from Clarksville, Va., the development to be undertaken by New York, Baltimore and Montana capitalists. A dam will be built creating a lake two miles wide, and it is calculated that about 40,000 horsepower will be developed. Electricity will be transmitted for lighting and power purposes to such North Carolina cities as Durham, Henderson, Oxford, Franklinton, Hillsboro, and to cities in Virginia. Besides this power the company plans in the future to develop 5,000 horse-power at Hyco falls, on the Dan river, and 5,000 horsepower at Tally falls, on the Staunton river, these two streams being head waters of the Roanoke.

SYNDICATE NOW CONTROLS FEDERAL TELEPHONE COMPANY—Negotiations have been completed by which the independent telephone syndicate, organized by James S. Brailey, Jr., Toledo, Ohio, purchased the controlling interests in the various telephone properties controlled by the Federal Telephone Company, of Cleveland, Ohio. The transaction involved more than $2,500,000. Among the firms interested in the syndicate are Secor & Bell, Toledo; Otis & Hough, Wright, McCloud & Baker, Cleveland; Bauer Brothers and the Atheimer & Rawlins Investment Company, of St. Louis. The Brailey syndicate also secured control of the subsidiary companies of the Federal Telephone Company. It has enlarged its holdings materially in the Cuyahoga Telephone Company, but the majority of that company's stock still remains in the hands of Cleveland capitalists. The reorganization of the United States and Cuyahoga telephone companies has been effected. Action has been taken placing the common stock of the Cuyahoga company upon a four per cent basis, and that of the United States company upon a three per cent dividend basis. H. C. Stifel and A. H. Bauer, of St. Louis; George Eustis, of Cincinnati, and Addison Hough, of Cleveland, were elected to the board of the Cuyahoga company. C. A. Otis was elected to the board of the United States company, succeeding F. S. Dickson. The retiring directors of the Cuyahoga company are J. B. Hoge, W. H. Lamprecht, R. A. Harman and H. P. McIntosh, all of Cleveland.

TROLLEYS FOR CHICAGO—The Chicago (Ill.) city council has passed a revokable grant to the city railway companies of Chicago which will mean the wiping out of the cable car system and the lowering of the tunnels in the river at once. This is the most far-reaching and comprehensive step toward the settlement of the traction question that has been taken for years. Under the new ordinance the Chicago City Railway Company gets six months in which to convert the cable system to an electric system. The granting of the trolley franchise to the new Chicago Railways Company was accomplished without opposition. The necessity for such action was held to be the lowering of the tunnels under the river, as ordered by the Federal government. The North and West Side companies are to go ahead and lower the La Salle, Washington and Van Buren street tunnels. If the city takes over the properties it is to pay the car companies the cost of remodeling the tunnels. Work on the tunnels is to begin as soon as the cable lines are electrified.

TELEPHONE AND TELEGRAPH.

MOUNT UNION, IOWA—A franchise has been granted to the Henry County Telephone Company for a period of twenty years.

BELLEVILLE, ILL.—The Bell Telephone Company will erect a $30,000 building on the property which it recently bought in Belleville.

HUNTINGTON, W. VA.—The Huntington & Teays Valley Telephone Company will rebuild the line between Barboursville and Hurricane.

CHICKASHA, I. T.—The Topeka & El Reno Telephone Company is installing an additional switchboard, which will give it a capacity of 900 telephones.

COLUMBUS, OHIO—The Central Union Telephone Company has taken out the permit for its new six-story building in Third street. The structure will cost $90,000.

HUNTSVILLE, ALA.—Madison county is rapidly being covered with a network of telephone wires radiating from Huntsville. The Southern Bell Telephone and Telegraph Company has just completed a line connecting the city with the exchange of the Inter-County Telephone Company.

SCRANTON, PA.—A merger has been formed by the Honesdale Telephone Company with the Consolidated Telephone Companies, of Pennsylvania. The corporation will rebuild the Hawley and White Mills branches, and one pair of wires will be placed from Honesdale to Scranton, to be used exclusively for Honesdale business.

AVOCA, N. Y.—George C. Silsbee, who for several years has been the general manager of the Avoca Telephone Company, which has operated the local lines of the New York & Pennsylvania Telephone Company, has sold his lease, the wires, poles, etc., to the original owners, who have taken charge of the business. It is announced that the Avoca lines will be under the general supervision of George Reynolds, of Bath.

ROCKVILLE, MD.—The Chesapeake & Potomac Telephone Company has closed a deal for the purchase of all the property and franchises of the Enterprise Telephone Company, of Montgomery county, the consideration being $7,000. This gives the Chesapeake & Potomac company control of all the telephone lines of the county. It is understood to be the purpose of the company to place the lines in first-class condition and establish an excellent service throughout the county.

ELECTRIC LIGHTING.

LUMPKIN, GA.—Lumpkin will hold an election on July 2 to decide the question of installing a municipal electric light plant.

PADUCAH, KY.—The Paducah council has voted $20,000 to repair the electric light plant, pending a settlement of the municipal ownership question.

BOONEVILLE, QUEBEC—A. Robbecks has been granted a thirty-year electric light franchise by the town of Booneville. The work of installing the plant will begin at once.

HALIFAX, NOVA SCOTIA—Halifax interests have purchased the plant of the Dartmouth Gas, Electric Light, Heat and Power Company, Limited. It is understood that the purchase price was $30,100.

GREENVILLE, S. C.—Joseph G. Cunningham is engaged in securing rights of way for the power transmission line of the Savannah River Power Company, from its generating station on the Savannah river, ten miles below Anderson, to the city of Greenwood.

ROCKFORD, WASH.—An ordinance has passed the city council granting to H. W. Collins, for fifty years, a franchise to furnish electric light and power and to erect poles along the streets and alleys. Work is to commence within sixty days, and to be completed within twelve months.

TIVERTON, MASS.—At the annual meeting of the Tiverton Electric Light and Power Company the following directors were elected: Edward L. Anthony, Rufus W. Bassett, Albert F. Dow, Frederick O. Dodge and Robert S. Goff, of Fall River; John R. Hicks and George R. Lawton, of Tiverton.

MISSOULA, MONT.—The Missoula Light and Water Company has purchased the heating plant in the rear of the First National Bank building from the Missoula Mercantile Company. It is the purpose of the Missoula Light and Water Company to install a lighting station, which will be an auxiliary to the station at Bonner.

SPOKANE, WASH.—The Telluride Power Company has begun work on its $3,000,000 irrigation and power plant project in Montpelier valley in Idaho. The first work will be to drive a tunnel through a mountain near Soda Springs. Water is to be taken from Bear river to the power-house through a pipe, and to the tunnel to a point on the west side of the mountain.

LOS ANGELES, CAL.—Permission has been granted to the Edison Electric Company by the park commissioners to set poles and string wires across Griffith Park. The line of wires is to be stretched from the northern boundary to the southern line, a distance of between two and three miles, and will be used by the Edison company to bring power from Kern river.

TROY, N. Y.—The Troy board of contract has awarded a contract to the Troy Gas Company to furnish 468 arc lights of 2,000 candle-power at twenty-six cents per night per lamp. The old price was thirty-two cents. The saving to the city is about $17,000 a year. The contract is to remain in force from the first day of June, 1906, until the last day of May, 1911.

COLUMBUS, OHIO—The finance committee of the Columbus council has decided to recommend the ordinance to provide for increasing the capacity of the municipal light plant. It involves an issue of bonds to the amount of $14,000. It was said by the board of service that it is now costing $29 per lamp per year to operate the plant, not including interest on investment.

PHŒNIX, ARIZ.—It is announced that the controlling interest in the Phœnix Light and Fuel Company has passed from the hands of Mrs. T. W. Pemberton to E. B. Gage, of Tombstone. The old company will be absorbed by the Edison Electric Company, of which the following are the directors: Jacob L. Gray, Byron Story, Herbert F. Keenan, A. S. Glasgow and R. C. Neill, all of Los Angeles.

LITTLE ROCK, ARK.—Articles of incorporation have been filed with the secretary of state for the Southern Power and Development Company, of Altus, Ark., of which D. A. Allen, John Allen and J. D. Crockett are the incorporators. It is proposed by this new company, which is capitalized at $50,000, to build a dam across the Little Missouri river, near Altus, and erect a water and electric light plant for the purpose of furnishing water and light to the adjoining section.

ELECTRICAL SECURITIES.

The stock market last week experienced a positive declining movement with a sharp break in the latter part of the week, the net result of which has been the lowest showing of security prices since the unsettlement following the San Francisco disaster. Following this decline there have come rumors that the crop report has been more satisfactory than the real conditions warrant, and the government figures show the wheat crop to be slightly below the average trade estimate. The total exports in merchandise in May showed a net gain and amounted to $130,549,287, against $123,793,569 last year. Imports in May were $104,948,493, against $92,525,424 a year ago.

ELECTRICAL SECURITIES FOR THE WEEK ENDING JUNE 16.

New York:	*Closing.*
Allis-Chalmers common	20⅞
Allis-Chalmers preferred	57
Brooklyn Rapid Transit	80
Consolidated Gas	138
General Electric	166
Interborough-Metropolitan common	50
Interborough-Metropolitan preferred	82⅝
Kings County Electric	165
Mackay Companies (Postal Telegraph and Cables) common	74½
Mackay Companies (Postal Telegraph and Cables) preferred	73¼
Manhattan Elevated	149
Metropolitan Street Railway	110
New York & New Jersey Telephone	137½
Western Union	92¼
Westinghouse Manufacturing Company	156

The regular quarterly dividend of 1¾ per cent on Metropolitan Street Railway is payable July 16. Books close June 25 and reopen July 17.

The board of directors of the Western Union Telegraph Company has declared a quarterly dividend of 1¼ per cent upon the capital of the company, payable July 16 to the stockholders of record at the close of the transfer books on June 20. The company's statement for the quarter ended June 30, 1906, partly estimated, compares as follows: net revenue, $1,750,000; bond interest, $331,300; balance, $1,418,700; dividend, $1,217,023; surplus for quarter, $201,677; previous surplus, $16,659,192, a total of $16,860,869. The actual reports of the company for the quarter ended March 31, 1906, follow: net revenue, $1,469,159; bond interest, $331,300; balance, $1,137,859; dividends, $1,217,023; deficit, $79,164; previous surplus, $16,738,356; total surplus, March 31, 1906, $16,659,192.

Boston:	*Closing.*
American Telephone and Telegraph	138¼
Edison Electric Illuminating	240
Massachusetts Electric preferred	71
New England Telephone	135½
Western Telephone and Telegraph preferred	92

Philadelphia:	*Closing.*
Electric Company of America	11½
Electric Storage Battery common	72
Electric Storage Battery preferred	72
Philadelphia Electric	8
Philadelphia Rapid Transit	24½
United Gas Improvement	85½

Directors of the United Gas Improvement Company have declared a dividend of 2 per cent ($1 per share), payable July 14 to stock of record June 30.

Chicago:	*Closing.*
Chicago Telephone	115
Chicago Edison Light	145
Metropolitan Elevated preferred	70
National Carbon common	88
National Carbon preferred	119
Union Traction common	4⅛
Union Traction preferred	13¼

The annual meeting of the Chicago Edison Company has been adjourned until June 26.

ELECTRIC RAILWAYS.

DUNKIRK, N. Y.—The Dunkirk common council has granted a franchise to the Dunkirk Street Railway Company.

BOISE, IDA.—Contracts have been let for the grading of about ten miles of the Nezperce branch of the Lewiston-Southeastern Electric Railroad.

PRINCETON, ILL.—The contract for the grading of the electric line from Princeton to Bureau has been awarded. It calls for the completion of the work by September 1.

STEUBENVILLE, OHIO—The Steubenville Light and Traction Company has asked the Toronto council for a franchise to double-track its line through that town.

KENOSHA, WIS.—The Chicago & Milwaukee electric road is preparing to enter the freight business, and a special line is being built west of Waukegan to connect with Elgin and Joliet.

WATERLOO, IOWA—An effort is being made by capitalists of Waterloo to build an electric line from Waterloo to Des Moines, passing through Tama, Traer and perhaps Marshalltown.

BELLOWS FALLS, VT.—The Rutland Railway, Light and Power Company will issue $1,200,000 worth of forty-year bonds for immediate use to acquire the property of the Rutland City Electric Company and to extend and improve present holdings.

BOWLING GREEN, KY.—A movement in now on foot to build an electric line between Bowling Green and Scottsville, Ky. The movement is headed by W. L. Yarbrough and T. C. Mitchell, of Bowling Green. The road can be built and equipped for $100,000.

MUNCIE, IND.—The Muncie & Portland traction line, connecting Portland and Muncie, has been opened for traffic. The principal cities and towns touched by the line are Muncie, Albany, Dunkirk, Redkey and Portland. The road probably will be extended to Celina, Ohio.

MANCHESTER, N. H.—The Manchester Traction Company, of which William A. Tucker, of Boston, is president, has purchased the Goff Falls, Litchfield & Hudson Street Railway, and will operate the new line. Work has begun on the road at Goffs Falls and probably will be completed in about four months.

CHADRON, NEB.—The plans for an electric railroad between Belmont, in Dawes county, and Hay Springs, in Sheridan county, Nebraska, are practically consummated. This section is a good farming country. The farmers and stockmen, headed by W. S. McGannon, J. M. Cain and C. H. Bisping, are pushing the project.

GREELEY, COL.—The Denver, Greeley & Fort Collins railway has filed articles of incorporation. The company is capitalized at $50,000 and proposes to build 100 miles of electric road from Denver north through Denver, Adams, Weld and Larimer counties, with the terminus at Fort Collins. The directors are J. D. Housman, of Denver; A. W. Trenholm, Otto Bremer, Westcott Price and Ira Shott, all of St. Paul.

BROCKTON, MASS.—Construction has begun on the Plymouth County Street Railway. The section to be constructed first is between Marshfield and Brant Rock. It is proposed to continue the line through to Rockland and later to construct a three and one-half mile branch from Hanover to Cushing's Corner, to connect with the Brockton & Plymouth Street Railway. George H. Thomas and Walter Peterson, of Brant Rock, have become associated with the undertaking.

MANSFIELD, OHIO—The Cleveland, Ashland & Mansfield Railway Company, which was recently incorporated with a capital of $500,000 for the purpose of building an electric road from Mansfield to Ashland, has awarded the contract for the grading to L. B. Stanley & Company, of Collinwood, and it is stated that the work will be begun at once. The contracts for bridges, culverts and other material and equipment will be let soon. The company will make an effort to complete the work at the earliest possible moment.

NORWALK, OHIO—Within a short time the capital stock of the Sandusky, Fremont & Southern will be increased from $10,000 to $500,000, and a mortgage of $1,000,000 placed on the property. Of this amount $500,000 will be sold to complete the road from Sandusky to Fremont. The stock will be placed in the Lake Shore Electric treasury, and the bonds will be guaranteed by the Lake Shore. The Lake Shore Electric is now engaged in buying right of way for this property.

IRWIN, PA.—At a meeting of the stockholders of the West Newton & Webster Street Railway Company a formal transfer of its property was made to the Pittsburg, McKeesport & Westmoreland Company, which will build a line from Irwin to the Monongahela river at Donora, a distance of eighteen miles. The contract to build the line was let to the South Penn Construction Company. The trolley company has made traffic agreements to connect with the West Penn Company at Douglas and with the Monessen & Fayette City at Monessen.

SEATTLE, WASH.—John McQuade and Edwin S. Gill have secured a renewal of the franchise held by them for some months from the commissioners of Kings county for the construction and operation of an electric railway from the north boundary line of the county, with the privilege of constructing tracks and placing poles and wires on any county road between those points. According to the terms of the franchise the work of construction must begin within two years' time. The franchise is the same as that formerly granted to the petitioners.

MEMPHIS, TENN.—An interurban electric line from Memphis to Clarksdale, Miss., *via* Lakeview, with branches from Coahoma or Clover Hill to Friars Point, appears to be a certainty, and the Lake View Traction Company, which is backing the enterprise, hopes to begin construction this summer. The proposed line will parallel the Yazoo & Mississippi Valley from Memphis to Clarksdale. The company's cars will carry both freight and passengers. Thomas Taggart, of Indiana, is president of the company, and it has C. F. Farnsworth, W. A. Percy, R. F. Tate, Walter Goodman, Mike Roach and other Memphians among its stockholders. The company is capitalized at $100,000.

BUCYRUS, OHIO—The active work of building the Columbus, Marion & Bucyrus electric has begun, and construction will be completed by fall. The line will connect the Columbus, Delaware & Marion, which is now in operation from Columbus to Marion, with the Ohio Central Traction Company at Bucyrus, now operating to Mansfield and Shelby. Through these lines a Cleveland connection will be made. Next year the Columbus, Marion & Bucyrus will extend its lines northeast to tap the Lake Shore Electric at Plymouth. A second company has secured the right of way for a line from Bucyrus to Fremont *via* Tiffin, to connect there with a Toledo line. This road is expected to be in operation this year.

MANKATO, MINN.—Isaac A. Smith, a civil engineer of St. Louis, is investigating the feasibility of constructing electric railway lines from village to village in southern Minnesota, to connect larger cities. He indicated the possibility of a line being built from Blue Earth *via* Easton or Delevan, Minnesota Lake, Plum Valley, Wilton, Waseca, Palmer, Blooming Grove, Morristown and Warsaw to Faribault. He also thought well of a plan to run a line from Mankato to Waseca. Fairmont people are interested in the construction of an electric line from that city to Algona, Iowa. The Fairmont Business Men's Association has appointed a committee of five to take the matter up and report at a future meeting.

BIRMINGHAM, ALA.—The Tidewater Development Company, with capital stock of $100,000, has been incorporated by Birmingham and Tuscaloosa capitalists for the purpose of establishing steamship lines on the Warrior, Tombigbee, Alabama, Coosa, Mobile and other rivers running through that and other states, carrying on state and interstate commerce, building electric railways and power plants in Alabama and operating all of these. The company has secured the necessary franchise and right-of-way for the main line of railroad from Tuscaloosa to Gadsden. Other roads are also to be built and operated. The company proposes to establish a through route for freight by electric railway and steamship from the Tennessee valley to the Gulf of Mexico. J. M. Dewberry is president; Lewis Miller, vice-president, and J. W. Donnelly, secretary.

PERSONAL MENTION.

MR. CHARLES FORDHAM has been made manager of the Oswego (N. Y.) office of the Ontario Telephone Company.

MR. E. CLARK, of Valentine, Clark & Company, Chicago, Ill., and Mrs. Clark, were visitors to New York during the past week, stopping at the Hotel Imperial.

MR. R. C. BELL, who has been in the Edwardsville (Ill.) office of the Central Illinois Construction Company, has been placed in charge of the company's new office at East St. Louis.

MR. C. J. H. WOODBURY, of the American Telephone and Telegraph Company, Boston, Mass., received the degree of Doctor of Science from Union College, Schenectady, at its commencement on June 13.

MR. S. A. PHILLIPS, Philadelphia, Pa., has been appointed sole fiscal agent for the Kansas City & St. Joseph Street Railway Company, Kansas City, Mo. This road forms a direct connection from Kansas City to St. Joseph.

MR. DAVID LAIRD has taken charge as superintendent of the fifth division of the Southern Bell Telephone Company, with headquarters at Savannah, Ga. Mr. Laird goes to Savannah from Richmond, Va., where he was in charge of the local exchange.

MR. EDGAR H. BEDELL, a graduate of Stevens Institute, has recently joined the sales department of the New York office of the Bridgeport Brass Company to devote his time to the introduction of phono-electric wire. Prior to this connection Mr. Bedell was identified with construction engineering.

MR. W. J. BOWEN has severed his connection with the J. R. Garrett Company, of Marysville, Cal., and will become purchasing agent for the Northern Electric Company, with headquarters at Chico. Mr. Bowen has been associated with the Garrett company for the past thirteen years in many responsible positions.

DR. SCHUYLER SKAATS WHEELER, president of the Crocker-Wheeler Company, Ampere, N. J., sailed on June 14 on the steamship Barbarossa for a short European trip. He was accompanied by Professor Francis B. Crocker, professor of electrical engineering at Columbia University, New York city, who has been associated with him in business for many years.

MR. WILLIAM M. ROTHSCHILD, president and general manager of the St. Marys Incandescent Lamp Company, St. Marys, Pa., was a recent visitor to Chicago, Ill. Mr. Rothschild reports a great increase in the demand for the "Eureka" lamp. During his visit to Chicago he renewed a number of old acquaintances and closed several large contracts. From Chicago he made a flying trip to St. Louis.

MR. H. K. STROUD.

MR. H. K. STROUD, the advertising manager of the Electric Service Supplies Company, Keokuk, Iowa, brings to his work as advertising expert a practical printer's experience, which he has found to be a valuable asset in his work. At the early age of ten years Mr. Stroud was in his father's printing establishment at Philadelphia, Pa., hard at work assembling type to conform with various original ideas. His real advertising career began with the Model Heating Company, of Philadelphia, following which he was assistant manager for the H. W. Johns-Manville Company, of New York city. He has been advertising manager for Pierce, Butler & Pierce, Syracuse, N. Y. Mr. Stroud has contributed a number of articles on the subject of advertising to recent issues of prominent journals devoted to this subject.

MR. E. B. ELLICOTT, electrical engineer of the Chicago Sanitary Commission, with Mrs. Ellicott, was a New York visitor during the past week, stopping at the Hotel Imperial.

MR. GARDINER C. SIMS, having recently been elected to the presidency of the William A. Harris Steam Engine Company, of Providence, R. I., builders of Corliss engines, has resigned his position as general manager of the Marine Engine and Machine Company, Harrison, N. J., and will return to Providence to assume his duties there. The Harris company has purchased a tract of land at Central Falls, R. I., and plans are now being prepared for the building of new works.

MR. NIELS A. CHRISTENSEN, the Danish engineer and inventor, has become associated with the Allis-Chalmers Company, Milwaukee, Wis., which has purchased the rights to manufacture and sell the Christensen air-brakes and air-compressors. Mr. Christensen was born on August 16, 1865, at Toerring, Denmark. He attended the local public school until he was fourteen years of age, when he was apprenticed in Viele, a near-by city. During his apprenticeship he attended evening school and became proficient in the fundamental laws of physics and electricity. He entered the Polytechnic Institute, at Copenhagen, at the age of eighteen, and in that city engaged in practical work in machine shops, especially those devoted to shipbuilding and marine engineering. At the age of twenty-three Mr. Christensen journeyed to London, England, and secured an engagement as a designer in an engineering plant. Finding it a little difficult to get along because of his lack of knowledge of the language, he shipped on an English vessel as third engineer, studying meanwhile, and upon returning to London he became a designer with a large firm that had works and principal offices in Liverpool and a branch office and engineering staff in London. With this concern Mr. Christensen designed the machinery and made the general plans for the new waterworks at Calcutta, India, and also designed the machinery and general layout for the Chilian Nitrate Works of Colonel North. Later Mr. Christensen had charge of the designing department of a manufacturing concern at Darwen, Lancashire, engaged in the manufacture of Corliss engines and textile and paper-making machinery. In 1891 Mr. Christensen arrived in New York. He proceeded at once to Chicago, Ill., where he became connected with Fraser-Chalmers Company as designer of Corliss engines. He had invented a new Corliss engine valve gear and tried to have this design accepted, but the company had just finished a new set of designs and was not disposed to alter them at once. He remained in the draughting room until the spring of 1892, when he was put in charge of the engine and power-house contracting and correspondence. It was in this situation that the opportunity was opened for his successful studies of the power-brake problem. His first practical tests were made in Detroit, Mich., in 1893, but the industrial conditions in general during that year prevented the successful organization of a company to manufacture the new safety appliances. Mr. Christensen left Chicago and entered the designing room of the E. P. Allis Works, at Milwaukee, Wis. Early in 1894 he developed a new system of quick-acting automatic brakes for steam railroad cars. In 1896 he secured financial help to make an experimental apparatus and secured patents on the device. The Christensen Engineering Company was organized in Milwaukee in the early part of 1897. In the fall of 1902 the scope of the company was broadened to include general electric manufactures, and this step led to the retirement of Mr. Christensen as general superintendent. Mr. Christensen has now consolidated his interests with those of Allis-Chalmers Company, going to this institution as consulting engineer.

MR. NIELS A. CHRISTENSEN.

INDUSTRIAL ITEMS.

THE METROPOLITAN ENGINEERING COMPANY, New York city, has issued a convention number of its bulletin. This bulletin describes the many forms of electric signs which the company is building.

THE DOUBLEDAY-HILL ELECTRIC COMPANY, the large electrical supply house at Pittsburg, Pa., has a resident representative, Mr. Elliott Reynolds, at 605 Union National Bank Building, Columbus, Ohio.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., in bulletin No. 3075 describes and illustrates the type R engine-type alternator. This bulletin will be found of value by any one interested in this direction.

THE REYNOLDS ELECTRIC FLASHER MANUFACTURING COMPANY, Chicago, Ill., owing to a great increase in business has found it necessary to move into larger quarters. The company is now established at 191-193 Fifth avenue.

PASS & SEYMOUR, INCORPORATED, Solvay, N. Y., will send complete information concerning the "P. & S." double-pole socket. This socket is attracting a great deal of attention. The company is calling particular attention to its future delivery contract proposition.

THE UNION SWITCH AND SIGNAL COMPANY, Pittsburg, Pa., in bulletin No. 24 describes a new line of apparatus for the protection of street and highway crossings. The Union electric crossing bells are described in detail, and detail views are given of the apparatus and its applications.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., in circular No. 1132 describes and illustrates Westinghouse protective apparatus. In addition to the text describing the devices there are views of the various elements and illustrations of typical applications.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, New York city, is mailing a unique folder calling attention to the completion and occupancy of its new building at 17 Park place and 14 Murray street. The folder includes a map of downtown New York, giving a great deal of valuable information.

THE WELLMAN-SEAVER-MORGAN COMPANY, Cleveland, Ohio, has published section C of its catalogue descriptive of iron and steel works equipment. This catalogue takes up open-hearth and reheating furnaces. The text is carefully arranged, and the illustrations are worked out with remarkable clearness and great attention to detail.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., has ready for distribution a folder and a handsome catalogue descriptive of its "Wood" fan motors. These will be sent to any one interested upon request. Bulletin No. 1075, which has been issued recently, describes direct-connected type MPL direct-current generators for power and lighting.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., will be pleased to send to any one interested, upon request, a folder entitled "The Rise of a Great Company." This is a reprint from the annual trade review of the Milwaukee (Wis.) *Sentinel*. In addition to a number of brief sketches concerning the different departments of the Allis-Chalmers Company, a number of views of the various plants are given.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has recently sold to William Cramp & Sons Ship and Engine Company, Philadelphia, Pa., eight five and one-half-kilowatt motor-generators for United States navy gun-elevating equipments. An order has recently been received from Columbia University, New York city, for one 450-kilowatt, 250-volt, direct-current generator for lighting and power at the university.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is calling attention to its switchboard and portable measuring instruments in a neat folder which will be sent for the asking. The line of instruments made by this company is very complete. In addition to the folder, the company will be pleased to send bulletin No. 67 on switchboard instruments and bulletin No. 71 on portable instruments.

THE RAMSEY ENGINE COMPANY, Bullitt Building, Philadelphia, Pa., has been formed for the purpose of exploiting the Ramsey crank mechanism, which is a device applicable to all single-acting engines. The officers of the company are: president, Robert H. Ramsey, inventor of the Ramsey crank mechanism; vice-president and general manager, Russell H. Ramsey; secretary and treasurer, R. Howard Eisenbrey. Mr. Russell H. Ramsey and Mr. Eisenbrey were formerly connected with the Harrison Safety Boiler Works, of Philadelphia. It is understood that the new company will not manufacture engines, but that it will issue license rights to engine manufacturers.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has ready for distribution a new series of literature, including fliers Nos. 2186, 2187 and 2188, describing and illustrating, respectively, cast grid rheostats and supply parts, primary cutouts for pole line work, and type MD manhole fuse boxes. There are also bulletins Nos. 4438, 4439 and 4440, describing, respectively, alternating-current two and three-phase induction motor panels for 2,080 volts, twenty-five to sixty cycles; GEA-605-A railway motor, and twenty-five-kilowatt Curtis steam turbine generator. A booklet on electric radiators gives some new information concerning this apparatus. The text is supplemented by numerous illustrations of typical applications of the luminous radiator.

THE CHICAGO PNEUMATIC TOOL COMPANY, Chicago, Ill., has published a special circular, No. 56, describing special electrical tools and accessories. This circular calls attention to portable grinders or buffers, portable pressure blowers, drilling stands, and a new design of a magnetic holder or old man, together with the air-cooled "Duntley" electric drill and standard types of "Little Giant" drills. In addition to the electrical tools the circular calls attention to riveting, chipping and caulking hammers and air-compressors. A test was recently made of the air-cooled Duntley electric drill on the rails of the Montreal Street Railway Company, Montreal, Canada. The power to run the drill was taken from the trolley wire, and ten and one-quarter-inch holes were drilled in sixteen minutes. Upon work which ordinarily took twenty-five minutes, the Duntley drill performed in thirty-five seconds. The test was made by the N. J. Holden Company, Limited, of McGill street, Montreal.

LEGAL NOTE.

NEW YORK EDISON COMPANY LOSES INSURANCE SUIT—One of the most important decisions affecting electric light companies and insurance laws rendered in some years was handed down on June 6 by the Court of Appeals. The case, extending over five years, was one in which several fire insurance companies of New York city attempted to obtain judgment for about $100,000 against the New York Edison Company. The opinion gives judgment to the insurance companies. The case grew out of a fire which took place in New York city, in which a block of buildings was burned. The insurance companies alleged that the fire was caused by defective electric light wires and improperly erected and maintained electrical contrivances. Suit was brought against the light companies singly, but they combined, and the final suit was brought, after several minor suits, against the Edison company. The case involved several new questions of the capacity of wires carrying both direct and alternating current, under varying conditions. The Court of Appeals held that the opinion of the National Board of Fire Underwriters concerning what is good and what is bad construction is not competent evidence at a trial of this kind, and also that the rules adopted by the Board of Electrical Control, of New York city, are not competent to be introduced. It also held that certificates issued by the city of New York to the effect that inspections have been made and that the rules have been complied with are not competent evidence. The statutes passed by the city of New York also are held not to be competent at a trial of this nature.